

COMPTON'S
PICTURED ENCYCLOPEDIA
AND
FACT-INDEX

INTERESTING • ACCURATE • UP-TO-DATE



*To inspire ambition, to stimulate the
imagination, to provide the inquiring
mind with accurate information told in
an interesting style, and thus lead into
broader fields of knowledge — such is
the purpose of this work*

VOLUME 2

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Here and There in This Volume

AT ODD TIMES when you are just looking for "something interesting to read," without any special plan in mind, this list will help you. With this as a guide, you may visit far-away countries and watch people at their work and play, meet famous persons of ancient and modern times, review history's most brilliant incidents, explore the marvels of nature and science, play games—in short, find whatever suits your fancy of the moment. This list is not intended to serve as a table of contents, an index, or a study-guide. For these purposes consult the Fact-Index and the Reference-Outlines.

For the Reading and Picture Hour

| | |
|--|------|
| WATCH THE BEAN PLANT GROW | 66 |
| THE STORY OF THE BEAR | 67 |
| IN THE WORKSHOP OF THE BEES—A GROUP OF NATURE PICTURES | 73 |
| THE BEETLE CIRCUS DOWN BY THE POND | 81 |
| LEADING FAMILIES AMONG OUR BIRD PEOPLE—A PICTURE GALLERY | 133 |
| HOW TO ATTRACT AND STUDY BIRDS | 141 |
| THE BISON, VANQUISHED MONARCH OF THE PLAINS | 149 |
| SOME PRIMITIVE TYPES OF WATER CRAFT | 162 |
| THE LIFE HISTORY OF A BUTTERFLY | 283b |

Parent and Child; School and Home

| | |
|-------------------------------------|-----|
| BABY CARE | I |
| BOY SCOUTS AND THEIR WORK | 213 |

High Lights in History's Pageant

| | |
|---|-----|
| EMPIRES THAT FLOURISHED WHEN THE WORLD WAS YOUNG | 5 |
| HOW A SPIDER GAVE NEW COURAGE TO A SCOTTISH KING | 252 |
| THE BYZANTINE EMPIRE AND ITS THOUSAND YEARS OF SPLENDOR | 289 |

Some Famous Men and Women

| | |
|---|-----|
| CLARA BARTON, THE "ANGEL OF THE BATTLEFIELDS" | 52 |
| THE MARTYRED ARCHBISHOP OF CANTERBURY | 72 |
| BISMARCK, THE MAN OF "BLOOD AND IRON" | 147 |
| JAMES BUCHANAN, 15TH PRESIDENT OF THE UNITED STATES | 255 |
| BURBANK, THE WIZARD AND HIS PLANT "FACTORY" | 276 |

Tours Through North and South America

| | |
|--|-----|
| BALTIMORE, THRIVING METROPOLIS OF MARYLAND | 33 |
| BOLIVIA AND ITS MOUNTAINS OF UNTOUCHED WEALTH | 168 |
| HISTORIC BOSTON, NEW ENGLAND'S GREATEST CITY | 199 |
| THE GIANT REPUBLIC OF THE AMAZON BASIN | 225 |
| THE SUNSET GATEWAY PROVINCE OF CANADA | 244 |
| BUENOS AIRES—ONE OF THE WONDER CITIES OF THE WORLD | 259 |

HERE AND THERE IN THIS VOLUME

Travel-Views of Lands Across the Seas

| | |
|--|-----|
| THE CITY OF THE THOUSAND AND ONE NIGHTS | 14 |
| BRAVE AND THRIFTY BELGIUM—A LAND OF BATTLEFIELDS | 86 |
| A DAY IN BENARES, HOLY CITY OF THE HINDUS | 94 |
| IN THE CAPITAL OF THE GERMAN REICH | 98 |
| THE VAST AND SAVAGE ISLAND OF THE DYAKS | 196 |
| BURMA—LAND OF RICE AND PAGODAS | 278 |

Sports and Games and Other Worth-While Things To Do

| | |
|-----------------------------|-----|
| BASEBALL | 53 |
| BASKETBALL | 59 |
| BOATS AND BOATING | 161 |
| BOXING | 208 |

In the Plant and Animal World

| | |
|---|-----|
| THE GOOD AND ILL THAT BACTERIA DO | 12 |
| THE ROMANTIC STORY OF THE BANANA | 36 |
| BIRD-LIKE ANIMALS THAT "SEE" WITH THEIR WINGS | 63 |
| THE VERSATILE MEMBERS OF THE BEAR FAMILY | 67 |
| THE BEAVER—MASON, CARPENTER, AND ENGINEER | 70 |
| THE WONDERFUL SCIENCE OF LIVING THINGS | 111 |
| OUR CHARMING NEIGHBORS IN FEATHERS | 120 |
| BUTTERFLIES AND THEIR COUSINS, THE MOTHS | 282 |

The World at Work

| | |
|---|-----|
| THE STORES THAT "BUY" AND "SELL" MONEY | 39 |
| THE "BULLS" AND "BEARS" IN THE PIT | 160 |
| OUR DAILY BREAD AND HOW IT IS MADE | 228 |
| THE MAKING AND LAYING OF BRICK AND TILE | 236 |
| THE BRIDGE BUILDER AND HIS WORK | 239 |
| BUILDING GIANTS WITH BONES OF STEEL | 263 |

Guide-Posts to Literature, Art, and Music

| | |
|--|-----|
| THE BOY WHO STUDIED MUSIC BY THE LIGHT OF THE MOON | 10 |
| BALZAC AND HIS WONDERFUL PANORAMA OF HUMAN LIFE | 35 |
| BEETHOVEN, LONELY KING OF THE WORLD OF MUSIC | 79 |
| THE BIBLE, THE WORLD'S BOOK OF BOOKS | 101 |
| THE WOMAN PAINTER WHO KEPT A PRIVATE "ZOO" | 173 |
| THE WONDER OF A PRINTED BOOK | 175 |

Rambles Through Factland

| | |
|--|----|
| FLYING GAS-BAGS FROM MONTGOLFIER TO ZEPPELIN | 21 |
| HOW BAROMETERS FORETELL WEATHER | 49 |
| BELLS, THEIR HISTORY AND THEIR MANUFACTURE | 91 |

HERE AND THERE IN THIS VOLUME

Interest-Questions Answered in This Volume

- What insect lives its entire life in the body of another insect? 85.
- What plants are so small that one thousand of them can lie side by side on the head of a pin? 13.
- What tree sometimes has several thousand trunks? 45.
- When and how was cooking done in baskets? 58.
- Do living beings ever originate from non-living matter? 115.
- Why are butterflies given the scientific name of *Lepidoptera*? 282.
- What wood is used for making artificial limbs? 257.
- What animals often eat their own weight in food every day? 122.
- Why is the hour divided into 60 minutes? 5.
- What plant group includes man's worst enemies and some of his best friends? 12.
- Explain why an injury to the right side of the brain may cause paralysis of the left side of the body, and vice versa. 221.
- Why did the ancient Egyptians mix straw in their bricks? 236.
- Where are even the roofs of houses built of stone and why? 100.
- Which is usually heavier, the brain of a man or the brain of a woman? 219.
- What Norse god was killed by a branch of mistletoe? 16.
- What famous Scottish king was inspired by the example of a spider? 252.
- According to the Babylonian myth, how did mankind lose the gift of immortal life? 9.
- The Bible has been translated into how many languages? 103.
- Explain how nature has built the bird for flying. 120.
- How many species of birds now exist? 132.
- Why do beavers build dams? 70.
- Describe the remarkable eyes of the whirligig. 85.
- How many colors or pigments are present in the feathers of birds? 131.
- Mention three important differences between plants and animals. 112.
- How can bats "see" with their eyes closed? 63.
- What is a scarab? 83.
- Explain briefly the resemblances and the differences between birds and reptiles. 120-1.
- How did beetles get their name? 82.
- Why was the strait of the Bosphorus given that name? 198.
- How do the tulip and the crocus get a start over most other plants in the spring? 269.
- Of what are shoe buttons made? 288.
- A person who has fainted should be laid flat. Explain why. 158.
- What is a clearing house? 42.
- Does a large brain indicate intelligence? 219 table.
- How does a barometer help to forecast weather? 49.
- How is air used to stop a train? 224.
- What plant sometimes grows a foot a day? 35.
- Which state now produces most of the world's supply of borax? 192.
- What part of your body weight is blood? 157.
- What explorer is the only man who flew over both the North and the South poles? 289.
- Who was the first man to go up in a balloon? 21.
- Explain why Buddhists never take life of any sort. 259.
- How long does it take a hen's egg to hatch? 128.
- Why have attempts to cultivate the blueberry usually failed? 159.
- Why are bobolinks welcomed by farmers in the North and dreaded in the South? 166.
- How do the worker bees carry pollen? 73-4, 75 picture.
- Explain how the Black Death helped to end the Middle Ages. 153.
- Who wrote: "Reading maketh a full man, conference a ready man, and writing an exact man"? 11.
- Who laid the cornerstone of Bunker Hill Monument? 272.
- How did Bombay become an English possession? 171.
- What is meant by hybridization? 276.
- What king's heart went into battle without him? 252.
- When was the Bible first translated into English? 103.
- What was the "Babylonian Captivity"? 174.
- How are book sizes indicated? 181.
- What is meant by majuscule and minuscule? 177.
- Where is the oldest school in the United States? 201.
- When was the first savings bank opened? 40.
- Which was the only South American republic to declare war on the Central Powers in the World War of 1914-1918? 228.
- Where does "Chinese jade" come from? 278b.
- What is the Braille alphabet? 156.
- Are bats birds? 63.
- What city is the world's highest capital? 169.
- Why do the wild men of Borneo build steep roofs? 196.
- Where is the "Fertile Crescent"? 7, 8 map.
- Why is Bagdad an important trade center? 14.
- What was the first land in the New World sighted by Columbus? 15.
- What empire includes one-fourth of the globe? 247.
- Which oriental city has more idols than inhabitants? 94.
- Which South American city has a subway system? 260.
- Which is the only Portuguese-speaking country in South America? 225.
- What great artist had a private menagerie? 173.
- Who was the "ploughboy poet"? 280.
- Who are "the three B's" of music? 218.
- What poet said of himself: "I awoke one morning to find myself famous"? 289.

Key to Pronunciation

Pronunciations have been indicated in the body of this work only for words which present special difficulties. For the pronunciation of other words, consult the Fact-Index. Marked letters are sounded as in the following words: *cāpe, āt, fār, fāst, what, fāl; mē, yēt, fērn, thēre; īce, bīt; rōw, wōn, fōr, nōt, dō; cūre, būt, rūde, full, bārñ; ü* = French *u*, German *ü*; *gem, gō;* *thin, then; ñ* = French nasal (*Jean*); *zh* = French *j* (*z* in *azure*); *κ* = German guttural *ch*.



BABY CARE. The physical growth and the mental development of the baby are processes that cannot be separated. They must both be understood by the parents and favorably influenced by intelligent care. (See Child Growth and Development.)

The first matter to consider in discussing the care of the baby is the family and the surroundings. Babies thrive best, physically and mentally, in a harmonious family environment in which mother, father, and child feel secure in their relations one to the other. Young people who anticipate rearing children should know how to establish their home life and their relationships to each other on a sound basis of mutual affection and confidence. A happy and harmonious living together of parents is the first requirement for the best rearing of the baby.

The care given the baby during the first few months of life is of especial importance for two chief reasons. First, of course, is the fact that the new-born infant is completely helpless, and could not survive without proper care. Second, the *manner* in which this care is given during the first year of life helps determine the establishment of all the earlier habits that every infant must acquire. The eventual healthy mental growth of the child is best assured if proper steps are taken for his physical care in early infancy. His mode of life during the first year may be one that gives him a good start on the road to a stable, healthy, joyous childhood, or on the other hand it may be fretful, unhappy, and uncomfortable for both mother and infant.

Too often, the very first days during which the mother has responsibility for her newly born infant are unnecessarily days of trial and stress. Such anxious days can be avoided if the new mother will prepare herself for her task. She should acquaint herself, not with a great deal of theory about child care, but with the simplest needs of the child and how to meet those needs. If the baby is born in the hospital, she should have been instructed in the routine of care while there. She may expect that the first day or two at home will not be quite as peaceful for the child, who probably at first frets more than in the hospital. This is the time for the young mother *not* to become alarmed, disturbed, or anxious at every small sign of discomfort. But suppose we begin at the beginning.

The baby enters the world in an extremely uncomfortable manner and finds himself in strange surroundings and exposed to many new experiences; therefore he cries. Hence the first thing that should be done is

to provide him with the warmth and darkness to which he has been accustomed, by putting him to bed, well covered, in a darkened room. In cold weather it may be necessary to use hot-water bottles under the mattress and outside the blankets.

The First Bath

After a few hours, when he has become acquainted with his new surroundings and his new mode of life, the first bath is attempted. The room should be warmed to about 80 degrees Fahrenheit, and the baby stripped and placed on a warm blanket. He is then thoroughly sponged either with water and castile soap or with oil and then gently dried. The navel should be let alone and covered with a sterile gauze pad about 2 inches square held in place by a binder which completely surrounds the abdomen. If the antiseptic which the physician instilled into the baby's eyes soon after birth discolors the surrounding skin, it may be washed off gently. The eyes and the inner parts of the ears and nose should not be touched in this bath. It is customary to place the baby's bed so that the head is about 3 or 4 inches lower than the feet for the first 24 hours. This is to enable fluids and mucus to run out of the windpipe if they have been breathed in during birth.

During the first few days the baby should sleep practically all the time; he should be disturbed only for his daily cleansing, changing of diapers, and an attempt at breast feeding about three times a day. It is unnecessary to give any laxative at this time, although all the older books on child care spend much time in discussing the subject unnecessarily. It is advisable to offer water in a bottle during this time.

Establishing Right Food Habits

Now we come to consider the first really important ability which the baby will develop after he has learned to breathe: this is eating, or rather, at first, drinking. Perhaps we can better understand how this takes place if we trace the process as the baby feels it. As he lies quietly in his warm bed, some time in the first few days he is disturbed by an uncomfortable feeling in his stomach. This is due to strong movements of the stomach muscles, which usually occur in anyone's stomach when it is empty. We call this "hunger pain." The baby naturally responds with a vigorous cry. If he is immediately taken up and put to the mother's breast or given a bottle, he will eagerly make sucking motions and will soon be swallowing.

At this point in our baby's existence an extremely important thing happens. With the first swallow of

liquid, his pain ceases. We see therefore that in this proper management of his first meal the baby has learned one of the most important lessons in life, that it is comforting to eat. He had a pain, and food relieved it. During the next one or two days this procedure should be repeated when the baby tells us that he has a hunger pain. After that, his feeding times should be arranged according to schedule, usually with a feeding every three or four hours. If he has learned the pleasure of nursing during the first few days, there is seldom any trouble in getting him to drink enough later.

The Baby's Appetite

This brings us to the subject of baby's appetites. We have seen how the appeasing of hunger brought about a pleasant sensation at the first meal. This feeling is the beginning of a good appetite. As the child is continually comforted by eating, he grows to enjoy the idea; and as each new eating experience is accompanied by the same reaction, he should grow up, as the normal child does, with a passionate desire for food. The child who does not enjoy eating is either ill, or has had something unpleasant repeatedly done to him at meal times. All through his babyhood one should allow the child to take the amount of food that he wants, and should avoid anything which could possibly disturb his natural enjoyment of meals.

Now that the baby likes to drink, the next question is *what* to feed him. For the first few months, nothing is as good as breast milk from his own mother. If the baby is put to the breast regularly, and if he is a vigorous baby, most mothers will have sufficient milk for the first few months. If, after a thorough trial, it is definitely proved that the baby will not thrive on the amount he gets from his mother, additional food must be given. This is offered to the baby in a bottle either after he has had what he can get at the breast, or instead of one, two, or three of the breast feedings. The usual additional food which is given nowadays is some modification of cow's milk, diluted evaporated milk, or some of the ready-made infant foods. Usually some form of sugar is added to these mixtures, because mother's milk has much more sugar than has cow's milk. In the United States, cod-liver oil and orange juice are usually added to the diet.

Weaning the baby is usually not a difficult matter if from birth he is occasionally given the chance to nurse from a bottle. If he is used to this method of feeding, it is a simple matter to substitute the bottle for the breast when artificial feeding becomes necessary. This is a matter of importance in the routine care of the baby because, unless this precaution is taken, the child may stubbornly refuse the change.

Food other than milk is usually offered at about the fourth month; at this time most physicians advise cereal once or twice a day. This is as much an educational as a nutritional experience, because it is teaching the infant to get used to the spoon. It is advisable to give the new food cautiously, never urging the baby to take more than he wants. As soon as he

gets used to the new method he will usually take all that is desirable. A month or so later, one may offer sieved vegetables or vegetable soup at the mid-day feeding, thus introducing still another taste thrill. Each new article of food should be given for two or three days in succession, so that those foods which cause trouble may be noted and eliminated.

During the second half of the first year the following foods are gradually added: baked potato, spaghetti, rice, egg yolk, scraped beef or beef juice, light desserts, toast or zwieback, crackers, cooked or raw fruits, and bacon. In the latter part of this time, it is well to present foods to the baby in a less finely divided form so that he gets a chance to use his teeth, which are now coming in, and becomes accustomed to lumpy food. The cup may also be used at this time, but only if the child likes it. By the end of his first year the child is thus taught to eat a large variety of foods from many receptacles. If we always treat his appetite with respect, and *never* force him at meals, he will persist in having a good appetite.

As a check on the feeding, the child should be weighed every day during the first month or so, and every week thereafter during the first year. For the first four or five months the child gains almost an ounce a day; later on this decreases to only about half a pound a month at the time he is one year of age. On the average, babies double their birth weight by about six months and triple it at one year of age. Wide individual variations occur, however.

At first the baby's routine should consist of sleep interrupted only by bathing, changing, and feeding. The bath should be a pleasurable experience if the room and the water are warm and the child is handled gently. At first it is only a sponge bath. Later on a full bath is given, with care not to allow nose, mouth, or ears to be submerged. After the soap and water, the child is carefully dried, and then oiled or powdered, depending upon whether his skin seems to be dry or oily. The common custom of cleaning out the ears, nose, eyes, and mouth with cotton applicators should not be permitted as a routine. Any noticeable discharge should be gently removed; but ruthless reaming is unpleasant to the baby and is often harmful.

Right Habits of Sleep

In addition to these things, which have to do mainly with the physical care of the child, it is important that we think of his habit formation during this first year. The child's physical growth and development can be favorably influenced if good habits of sleep are established. During his earliest days the infant tends to sleep most of the time. Gradually the amount of sleep is reduced; but the child should be permitted to establish this for himself. The very young infant will awaken when he is hungry or uncomfortable, and announce his needs. If he does not, he should be awakened for his regular feedings. By the seventh or eighth month, he will be taking two long naps a day, morning and afternoon, and will have his long, uninterrupted night's sleep of approximately 12 hours.

Not only is the *amount* of sleep important, but also the *habits* he establishes in relation to sleep. Every infant should preferably sleep in a room by himself after the first half-year. It is wise to establish the practise of placing the child in his crib, making sure that he is comfortable, and leaving him at once, with the room darkened and the door closed. If he is restless at first or cries, he should be let alone and he will soon settle down. If he awakens during the night because he is wet or uncomfortable, he should receive the attention he needs; otherwise he should not be disturbed. Sleep disturbance of healthy children often seems to be an attempt by the child to have the parents continue offering him attention and care.

Training in Cleanliness

The child requires training in proper control of bowels and bladder. Correctly approached, this training offers no great difficulty for child or mother. Conscious control of bowel movement is usually attained in the later part of the first year. Exceptionally early training does not usually lead to permanent control, and undue emphasis may lead to psychologic disturbances later. The most important feature of training is the establishment of *regular* habits of elimination. If the mother notes the child's natural tendency, she will see that normally he has bowel movements at fairly regular intervals. Definite habits can be established by encouraging the infant to have a movement, preferably directly after feeding, at the time each day at which a movement has usually occurred. The authors of this article believe it is a mistake to undertake training before the child is able to sit alone. As soon as the child is old enough, a suitable chair or seat should be provided. Suppositories and laxatives should be used only on the advice of the physician. There should be no over-emphasis of slips and accidents, but merely the persistent expectation that the child will conform.

Bladder control also can be established in due time and with little difficulty, if simple routine is persistently followed. During the earlier months after training in bowel control has been initiated, the child will become accustomed to emptying his bladder whenever placed upon the proper receptacle, even though he may wet himself at other times. During the first part of the second year, when the baby begins to walk about the house, it is well to set aside a day or two in which he is placed on the toilet often enough to keep him dry. If this is calmly and placidly carried out, training can often be speedily accomplished. During the last part of the second year, when daytime control of the bladder is well established, one may begin to teach control at night. Diapers should be removed at bed-time, with the statement that the child is now grown up enough to call for his mother or go to the bathroom if he awakens. This procedure should be repeated for two or three nights, with no emphasis on success or failure. If the child still wets the bed after two or three such attempts, the effort should be postponed for several weeks, and then

repeated with all confidence of success. Shaming and scolding do more harm than good. There should be no undue emphasis or fretting, but only the persistent and calm carrying out of the simple routine.

Play, Exercise, and Clothing

The very small infant gets all the exercise he needs in crying and in the activity incidental to bathing, feeding, and nursing. Freed of all his clothing at his bath time, he should be given opportunity to kick and exercise.

Babies should have simple toys and objects with which to play as soon as they are at all interested or able to use them. An infant five to six months of age will enjoy pounding with a spoon, and an unbreakable cup is a great satisfaction to one just learning to grasp objects. As his ability to use his hands increases, blocks and nests of hollow cubes are enjoyed. As soon as the toddler is walking, pull-toys add to the zest of getting about. At all times, the toys should be such as will help the child in mastering the particular physical accomplishments of which he is capable. Attention to the nature of his immediate interests, and to what he is ready to do or to learn to do, makes life more enjoyable for him and favors his learning processes. (See Play Materials.)

If he is not encumbered with too heavy clothing and coverings, the infant will display a great deal of activity during most of his waking time. Toward the age of six months he will be making attempts to sit up. During the last quarter of the first year, most infants will support themselves on their feet and walk with help. During the first part of the second year they will usually walk unsupported. When the child is learning to get about, he should have a suitable play pen, or some arrangement which gives him opportunity to support himself in moving about and at the same time protects him against injury.

Put the Child's Needs First

The child's *needs*, not the parent's *desires*, must invariably come first during the early years. It is natural for parents to desire to shower the baby with affection and attention—to display him and otherwise give vent to their great satisfaction in his growth and development; but this must *not* be at the expense of the routine so necessary to the development of good health and good habits. There is plenty of opportunity to enjoy one's child without sacrificing this routine.

A mental hygiene point of view would emphasize giving the child every opportunity to take each next step in development for which he is physically and psychologically prepared. This psycho-physical development is systematic and chronologically ordered, and few children vary widely from the usual developmental course. The most helpful training consists not only of the application of proper measures but their application at the proper time.

Many children are anxious and somewhat fearful in meeting new situations and new demands, and so one must give due heed to the child's weaknesses and ineptitudes. In general, children tend to venture

courageously, to attempt to do all manner of things for themselves, to want to "do it by myself." They also tend, some children more than others, to stick to the certainties of old and tried situations, and to resist change and forward movement. This latter tendency becomes emphasized in children who are not encouraged to do things for themselves.

The most successful mother is the one who knows what may reasonably be expected of her child, and makes it possible for him to meet this expectation. Too often, mothers so regret the passing of the period of infancy that they encourage retention of infantile habits. The child who is treated as an infant longer than he should be will remain an infant longer than necessary. Mothers can avoid this tendency if they realize not only that they must be proud of the child's growth and change but that they too must grow and change. The mother must be able to give up the early

delightful situation in which her tiny infant is so completely dependent, for a relationship changing with the child's growth. This new relationship will prove to be no less satisfying, in its way, than the first. Here the satisfaction, for both the mother and the child, lies in the fact that the small child begins to accomplish things for himself. Physically and mentally he becomes *capable* of doing things for himself. Whether or not he will *enjoy* his newer accomplishments is largely dependent upon the mother's attitude.

This article discusses only the basic principles of baby care. For detailed instructions about layettes, feeding schedules, nursery equipment, etc., write the Children's Bureau, U. S. Department of Labor, Washington, D. C., for its bulletin entitled "Infant Care" and a list of its other excellent pamphlets and folders on the care and training of children. Many state boards of health also have useful booklets for free distribution. A selected list of books of interest to mothers may be found with the Reference-Outline at the end of the article on Psychology.

ARTICLES NEEDED FOR THE NEWLY BORN BABY

| Clothing | | For the Bath Table | | For Preparation of Food | |
|-------------------------|---|--------------------------|--|----------------------------------|------|
| Cotton bands..... | 4 | Absorbent cotton | | Nursing bottles..... | 8 |
| Diapers, dozen..... | 4 | Safety pins | | Bottle rack..... | 1 |
| Shirts, cotton..... | 6 | Soft hair brush | | Nipples..... | 8-12 |
| Petticoats, cotton..... | 4 | Talcum powder | | Glass jars for nipples..... | 2 |
| Nightgowns..... | 6 | Castile soap | | Double boiler..... | 1 |
| Jackets..... | 2 | Boric acid solution | | Funnel..... | 1 |
| Socks, pairs..... | 6 | A soft blanket | | Fine sieve..... | 1 |
| Cloak with hood..... | 1 | Towels | | Measuring graduate, 8-ounce..... | 1 |
| Mittens, pair..... | 1 | Scales, bath thermometer | | Measuring spoons..... | 2 |
| Blankets..... | 2 | Olive oil, sterilized | | Cups and spoons | |

BABYLON. What London and Paris and New York are to the modern world, the city of Babylon was to the ancient. It was the capital of ancient Babylonia, situated on the Euphrates River about 70 miles south of the present Bagdad. Babylon was one of the oldest of cities, as we find it mentioned in records now more than 5,000 years old (about 3800 B.C.). But during the first thousand years of its known history, it was a mere village and played little or no part in the history of the region.

At the height of its glory Babylon was one of the greatest and most magnificent cities in the world. It was built in the form of a square, and was enclosed with brick walls of great height and thickness, defended by numerous towers. Its temples and palaces were adorned with glazed bricks and tiles picturing scenes from Babylonian history and religion. The "hanging gardens" of Babylon, built in terrace form and supported on arches which rested upon other arches, were one of the seven wonders of the world. In later days the name Babylon became a synonym for worldliness, luxury, and vice.

But Babylon was noted also as a seat of learning, education, and art. Excavations on the site by European scholars have revealed rich art treasures and many other interesting objects. Among these are the remains of a schoolhouse more than 4,000 years old—from the time of King Hammurabi. The building consisted of a number of rooms, with walls of sun-baked brick, built about an open courtyard.

On the floor were still lying the clay tablets of the pupils, with the exercises which they wrote on them more than 4,000 years ago.

What was school like in those long-ago days? The principal study was learning to form the wedge-shaped characters which we call cuneiform (*cū-nē-ī-form*) writing. It was necessary for the Babylonian boy to master three or four hundred different signs, instead of the few signs which make up our alphabet. Each pupil was given a tablet covered with soft clay, on which he wrote with a reed stylus. When the tablet was filled he could smooth out the marks with a flat stick or stone, or could make himself a new tablet with a fresh ball of clay.

In learning to write the pupil first made long rows of single wedges in three positions—horizontal, vertical, and oblique. When he could make the single wedges neatly, the master set him to work on the wedge-groups which form the signs themselves. Then he undertook words and phrases, and finally whole sentences and quotations.

The art of writing was very highly valued by these ancients. One of their proverbs reads: "He who shall excel in tablet-writing shall shine like the sun."

Babylon became the capital of all Babylonia about 2350 B.C. Various Assyrian kings attacked and conquered it, and in 689 B.C. its walls, temples, and palaces were razed to the ground because of a revolt against Assyrian rule. The city was soon rebuilt, however, and flourished for a time under independent rule. It rapidly declined when conquered by the Persians (538 B.C.). In 275 B.C. the remaining inhabitants were removed to a new city called Seleucia.

EMPIRES *that* FLOURISHED WHEN *the* WORLD WAS YOUNG

BABYLONIA AND ASSYRIA. Scholars are unable to tell us whether civilization first arose in Egypt or in that part of the valley of the Tigris and Euphrates rivers of western Asia which we call Babylonia. At all events, here lay one of the earliest cradles of civilization. (See Mesopotamia.)

Long before 3000 B.C., the predecessors of the ancient Babylonians (called Sumerians) were living in tiny city-states along the lower course of the twin rivers, in small towns built of sun-dried bricks. They irrigated their barley and wheat fields by extensive canals, and they wrote letters and kept records on tablets of baked clay by means of their curious wedge-shaped "cuneiform" writing. They used a system of counting by 60's instead of by 100's, from which has come our division of the hour into 60

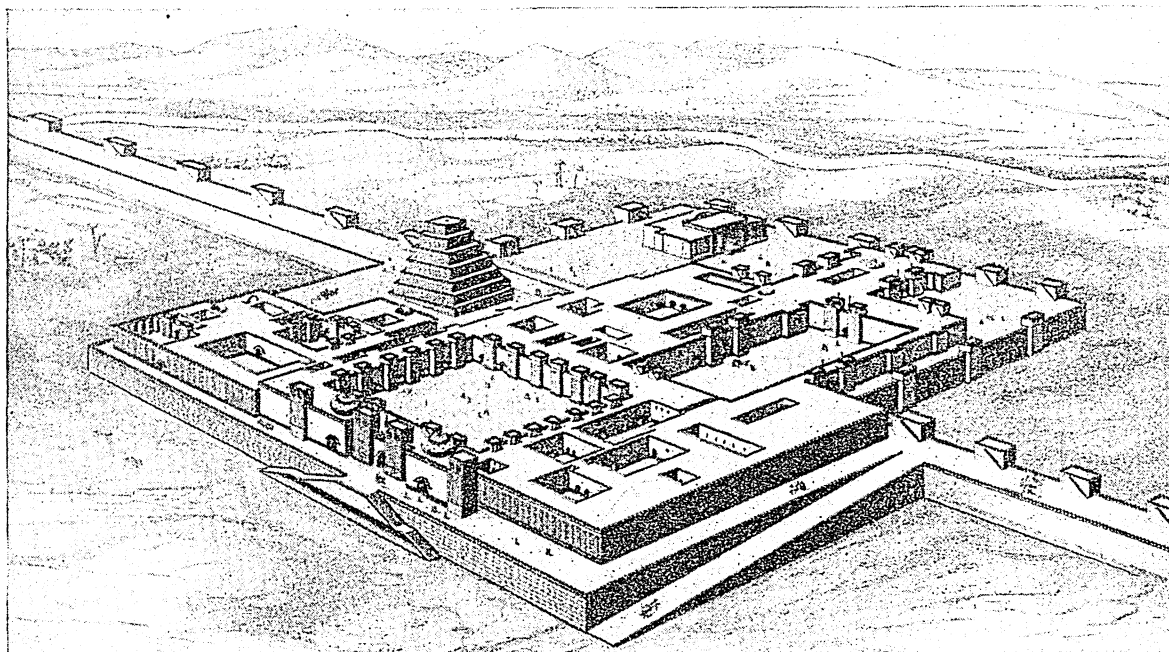
*G*REAT sculptured slabs of stone and glazed-brick pictures of lion-hunting kings, as well as whole libraries of baked clay tablets filled with the literature and learning of far-off times, attest the greatness of the civilization which flourished 5,000 years ago in the valley of the Tigris and the Euphrates rivers—where legend locates the site of the Garden of Eden.

around it, and the period 3050 to 2750 B.C. is known as the Age of the Sumerian City Kingdoms. The inhabitants had come from what are now the mountains of

Persia, to the east, and apparently were not related to any of the groups of people that we now know. The petty states were constantly warring with one another. They also had an outside enemy to meet in the wandering Semitic tribes of the Arabian desert to the west. Finally one of these Semitic chieftains from the desert, named Sargon, proved too strong for the Sumerians, and made himself master of the whole plain.

Sargon (about 2750 B.C.) was the first great leader in history and the first to build up a great nation. His kingdom soon reached from the Persian Gulf to the Mediterranean Sea, and gradually his nomadic

THE ROYAL RESIDENCE OF AN ASSYRIAN KING



Sargon II, king of Assyria, built this palace on a great elevated platform covering 25 acres, with inclined roadways on which he could drive up his chariot from the streets of the city below. Numerous courts furnished light to the surrounding rooms and halls. Such temple towers as that behind the largest court developed into the spires we see on churches today.

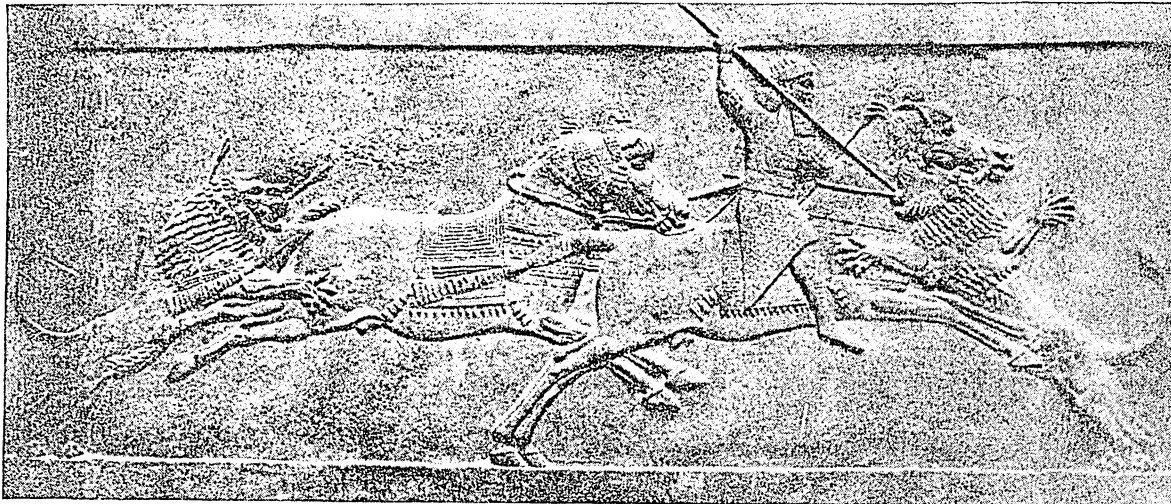
minutes and of the minute into 60 seconds. In the center of the Plain of Shinar (as Babylonia was then called) rose a great tower on a temple, which is regarded as the original Tower of Babel and the remote ancestor of our modern church steeples.

The Dawn of Civilization in Babylonia

Each one of the little towns of the Plain of Shinar in that early day owned the land for a few miles

followers dropped their unsettled life and took up fixed abodes in the plains. They adopted the civilization of their former enemies, gaining new arts of peace and of war. They learned to make helmets of leather and copper, which are the earliest known examples of the use of metal for protection in war. From this humble beginning evolved the armor of the medieval knights, and our steel-clad battleships.

HOW ASSURBANIPAL SLEW THE LIONS



This fine example of Assyrian animal sculpture records the prowess of Assurbanipal, last of the great Assyrian emperors. The rider of the horse in the rear, after having planted three arrows in the body of the king of beasts, has fallen. In depicting the human figure, the Assyrian artists were monotonous and formal, but they were remarkably successful in their modeling of animals.

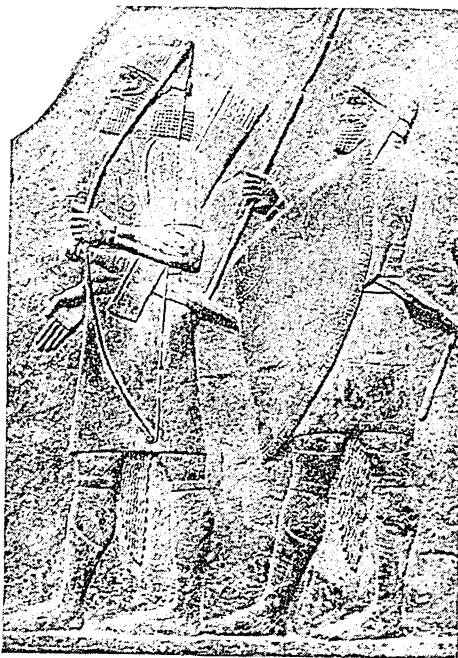
As the kings who followed Sargon slowly weakened, a new desert tribe of Semites invaded the land, and in turn established the kingdom of Babylonia, so named from its capital Babylon, which now arose to supremacy. Under the great ruler Hammurabi, about 2100 B.C., this new kingdom reached its height. Agriculture was extensively practiced, commerce flourished, and law and government were highly developed.

The cities which composed Hammurabi's kingdom have long been mere deserted mounds of earth and crumbled brick. But amid these ruins scholars have recently found over 50 baked clay tablets containing letters written by this king, and also a shaft of stone containing the priceless record of his laws. These writings enable us to bridge the gap of more than 4,000 years which separates us from Hammurabi's time and to reconstruct in part the daily life of his people.

Hammurabi's letters contain orders directed to officials in different parts of the kingdom. He orders the river Euphrates cleared of its obstacles to river commerce. Taxes must be collected and delinquents punished. Unjust judges and corrupt officials are brought to justice. The spring sheep shearing is

ordered to be celebrated as a great feast. Other letters deal with the temples and religion, the regulation of the calendar, and similar matters.

ASSYRIAN SOLDIERS OF THE EMPIRE

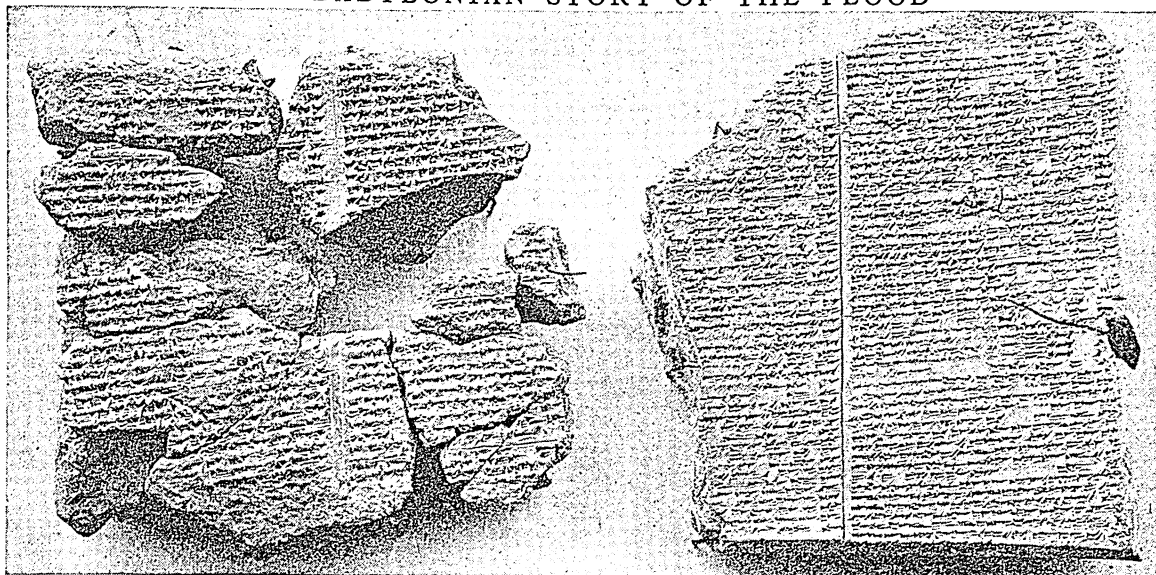


Such brawny men with spear and bow made Assyria the supreme power in the East. The great armies of the Assyrians were the first to be equipped with weapons of iron and the first to use the battering ram. It was men so armed that "came down like the wolf on the fold."

The laws of Hammurabi, chiseled in wedge-shaped characters on their shaft of stone, are the earliest code of law for any people which has come down to us. They are thus a priceless aid to making clear the earliest life of civilized man, long before the days of ancient Greece and Rome. In them we find a highly developed political and social system. There were three classes in the community—a ruling class of nobles and officials, a middle class, and slaves. Much attention is given to commerce, money, and banking, as well as to agriculture and the canals and ditches needed for irrigating the soil. Justice was insisted on for the widow, the orphan, and the poor, but punishments were usually based on the principle, "an eye for an eye and a tooth for a tooth." For example, if a house fell through the crumbling of its sun-baked bricks and killed the son of the householder, the guilty builder must also suffer the loss of his

son. The position of women in these laws was a high one, and they are shown as frequently engaging in business on their own account.

THE BABYLONIAN STORY OF THE FLOOD



On these baked clay tablets, which are among the priceless historic treasures of the British Museum, is inscribed, in cuneiform letters, the Babylonian story of the Flood. These clay pages are from the library of King Assurbanipal. Apparently people carried off other people's books and made marks in them in those days just as they do now, for the king had a bookmark calling down the wrath of heaven on anybody who did any of these things to the books in his private collection.

After Hammurabi's death his kingdom went to pieces. The wild tribes again descended from the eastern mountains to the plains, this time bringing with them a strange animal which the Babylonians called "the ass of the East," but which we call the horse. The newcomers failed to benefit from the civilization of Babylonia; instead, their ruder ways became the ways of the plains. Even the old Sumerian language was forgotten and a Semitic language, related to the Hebrew of the time of Christ, took its place. Babylonian progress was effectually stopped.

But in the northern part of the Tigris-Euphrates valley there had arisen a new nation called Assyria, from its chief town, Assur. At first Assur was a small city-state like those of Babylonia in the south, and it was usually under the control of its powerful Babylonian neighbors, from whom its people borrowed the calendar, writing, sculpture, and other improvements of civilization. By continual strife with their more advanced southern neighbors, and with the wild tribes to the north, the Assyrians gained skill in warfare, until they finally aspired to rule not only the valley of the two rivers but wider stretches to the west.

They started by conquering Babylon in the 13th century B.C. At the same time, the greatest nations of the day, Egypt and the Hittite Empire, were ruining themselves in wars for the mastery of the "fertile crescent" of well-watered land which runs from Egypt

through Palestine and Syria to Mesopotamia. Meanwhile the Jews were filtering into Palestine from the desert, and the Phoenicians were becoming great sea traders.

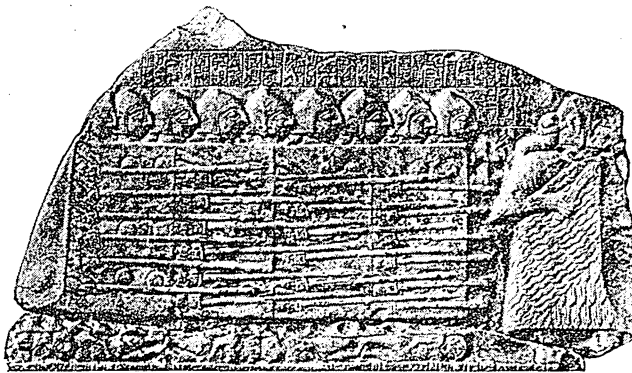
The collapse of Egyptian and Hittite power in Syria left the land divided into petty city states. These Assyria attacked one by one. The strongest, Damascus, surrendered in 732.

The conquest of the others soon followed, when, as the poet Byron tells us—

The Assyrian came down like the wolf on the fold,
And his cohorts were gleaming in purple and gold.

Assyria not only conquered Syria and Palestine, but her rule for a time extended even into Egypt. Two things contributed to this military success—first, the Assyrians were the first people to learn the use of iron weapons; and second, the organization of their whole state, like that of the later Prussians, was based on war and conquest. Like the Prussians,

THE MIGHTY PHALANX ON THE MARCH



The phalanx—a massed group of fighting men—which the Sumerians first introduced into the art of war, was one of the secrets of their success. Here we see a phalanx with the king at its head, and with spears set for the charge. The men's heads are protected by leather caps, and they have tall shields covering their entire bodies.

also, their rule was one of "blood and iron." One Assyrian king, Sargon II (722-705 B.C.), destroyed the northern kingdom of the Hebrews (called Israel) and carried away as captives part of its people.

Sargon's son Sennacherib (705-681 B.C.) destroyed the ancient city of Babylon, and even turned the waters of the canal over its ruins. Sargon II had built for himself a palace far surpassing anything yet built; the building covered 25 acres, and the inclosure was large enough to shelter 80,000 people. But this was not enough for Sennacherib, and he built as his capital the proud city of Nineveh, on the upper course of the Tigris. Within the palace halls were long stretches of pictures of the emperor's conquests, cut in alabaster slabs. The men in these reliefs all looked alike, except that the king was distinguished by his curled hair and beard; and they were all devoid of expression. But the animals on slabs picturing lion hunts and the like were very natural, and on the whole the art was far in advance of the art of the Babylonians. Literature advanced with art, and there is now in the British Museum in London a great collection of 22,000 clay tablets which have been discovered in the ruins of the ancient palace of Nineveh. This is one of the earliest libraries of which we know; it contained religious, scientific, and literary works, all carefully cataloged.

In the gardens of the palace were all manner of strange trees, including "cotton trees that bore wool which was clipped and carded for garments." These "cotton trees" are thought to be a tall species of the cotton plant which grows in our own southern states today. Interest in literature, art, and industry, however, was only incidental. The Assyrian Empire was still essentially military, and as conquest succeeded conquest it became more so, for a large army was needed to keep in subjection the conquered peoples. These subject peoples constantly grew more restive, for not only were they governed and taxed by the emperor at Nineveh, but they were forced to help him fight his battles.

The Chaldean and Persian Empires

The end of the Assyrian Empire came in 606 B.C. A desert tribe called Chaldeans had been slowly creeping in from the south and had overrun Babylonia.

Then they joined with the Medes, a tribe from the mountains to the east, and assailed Nineveh, the mighty city of Assyrian kings. The rejoicing of the world at the fall of Nineveh was expressed by the Hebrew prophet Nahum, who said: "All that hear the news of thy fate shall clap their hands over thee; for whom has not thy wickedness afflicted continually." Two hundred years later the Greek historian Xenophon could not even learn the name of the crumbling ruins where once had stood the proud city of Nineveh (see Nineveh).

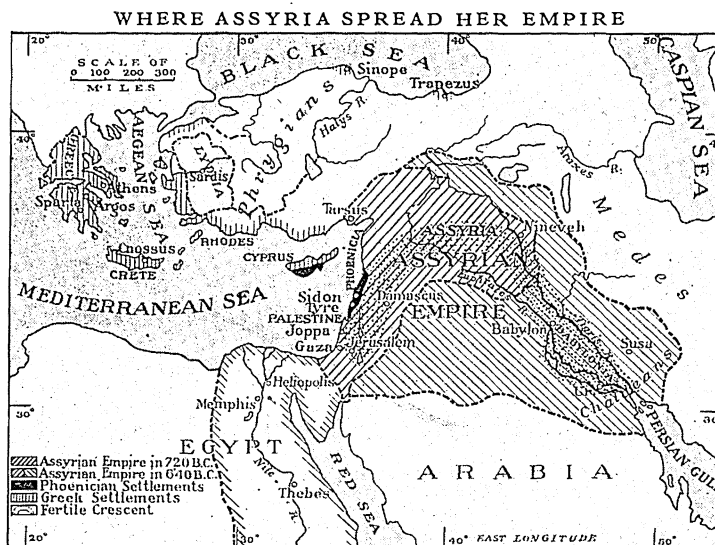
The new masters of the Tigris-Euphrates valley rebuilt the old city of Babylon and made it their capital. Here for over 40 years (604-561

B.C.) ruled Nebuchadnezzar, greatest of the Chaldean emperors. He enlarged the city and built enormous walls about it to protect it from its enemies. His palace surpassed in beauty that of any former ruler, and to please his wife he constructed the wonderful Hanging Gardens of Babylon, which the Greeks counted one of the Seven Wonders of the World. This is the Babylon described in the Bible as the city of the Hebrew captivity, for after one of their many revolts Nebuchadnezzar had destroyed Jerusalem and carried away the people into captivity.

Under the Chaldean or second Babylonian empire commerce and industry flourished, and literature and the arts were developed. Special progress was made in the science of astronomy, for the Chaldeans mapped out the sky into the 12 signs of the zodiac, and they knew the five planets, Jupiter, Mars, Venus, Mercury, and Saturn.

But the days of the Chaldean Empire were numbered, as Daniel told Belshazzar in the interpretation of his dream, and soon its lands were divided between the Medes and the Persians (538 B.C.).

This was the end of the great civilization of the Tigris-Euphrates valley, whose checkered course stretched far back down the corridors of time. It is strange to think that we are nearer today by a thousand years to the fall of the Chaldean Empire than were the Medes and Persians of that day to the faint far-off dawn of Babylonian civilization, over 3,000 years before, on the river plain of Shinar. With the



On this map you can trace the story of the short-lived Assyrian Empire from the days of its founder, Sargon II, to its greatest extent 80 years later under his great-grandson Assurbanipal (called Sardanapalus by the Greeks).

fall of Babylonia the course of empire started definitely on its westward way.

Since that time Mesopotamia has always been subject to some foreign people—the Persians, Greeks, Romans, Arabians, or Turks. The latest chapter in

its history began when British and Arabian forces wrested the region from the Turks during the World War of 1914–1918, and set up the Arab kingdom of Iraq. The kingdom became independent in 1932, with special rights reserved to Great Britain (*see* Iraq).

Babylonian Myths of Life and Death

Tales, Resembling the Stories of Our Bible, that the Mothers of Babylon Told Their Children Ages Ago



ORE than 2,000 years before Christ the ancient Babylonians had many quaint myths to explain the mysteries of life and death and man's history on earth.

These myths were doubtless still told among the Babylonians more than a thousand years later, when the Jews dwelt for 70 years as captives in that land.



So we can find traces of these stories in the Old Testament, and we also have the Babylonian stories themselves preserved in the quaint old wedge-shaped characters of their records.

The Shepherd who Soared to the Skies

One of these Babylonian stories tells of the wonderful adventures of a shepherd named Etana (*ā-tā'nā*), who was the first of mankind to attempt to fly. It happened once that his flocks were stricken with unfruitfulness, so that no more lambs were born. But he learned of an herb in heaven which was the source of life; and to obtain this and cure his flocks he induced an eagle to carry him on its back to the highest heaven.

The first gate was successfully passed. Then the eagle, bearing its shepherd passenger, mounted to yet dizzier heights. Its strength, however, now began

to fail, and just as Etana neared his goal, both he and the eagle were hurled to earth by the jealous gods, and perished.

The Man who Refused Immortality

The mystery of death is dealt with in the story of the fisherman Adapa (*ā'dā-pā*), who was one of the first men created. While he was busy at his trade one day, the South-wind goddess overthrown his boat, and Adapa in a rage seized and broke the goddess' wing. For this he was summoned before the throne of the Sky-god. When Adapa told of the mischief the South-wind had done him, the Sky-god excused him and even offered to him the heavenly bread and water of life. This would have made him immortal and destroyed death. But Adapa was suspicious and refused to eat or drink while in heaven, fearing that it was the bread of death and not of life. He thus lost both for himself and for mankind the precious gift of immortal life. Some scholars see in this Babylonian reference to the "bread of life" a resemblance to the Biblical "tree of life" planted in the Garden of Eden.

Babylonian Story of the Flood

Several Babylonian and Assyrian records tell of a great flood which once covered all that land, and how a man named Ut-Napishtim (*ōōt-nā-pish'tim*) and his family were saved by the favor of the gods.

The deluge is represented as sent upon the earth as a punishment for the sins of men. Ut-Napishtim, the Babylonian Noah, was warned in advance by the god Ea, who gave directions for the building of a great ship with strong roof or deck, in which "the beasts of the field and the birds of heaven" might be saved along with the hero and his family.

Then thunder, lightning, and rain came, with a hurricane which drove the waters of the deep over the land. After seven days the floods began to subside. Ut-Napishtim sent out from his ship in succession a dove, a swallow, and a raven. When the raven came back with signs of mud on his feet, he knew that the land was beginning to appear. The ship is represented as coming to rest on the highest peak of eastern Kurdistan, instead of upon Ararat, as

in the Bible account. Ut-Napishtim is then made immortal by the gods.

In its best-known form this Babylonian account is part of a long poem covering twelve tablets, found in the ruins of Assurbanipal's palace at Nineveh. It is called the "Epic of Gilgamesh." Ut-Napishtim tells the deluge story when the hero Gilgamesh visits him in a wonderful land across "the waters of death," as an explanation of his perpetual youth.

BAC'CHUS. The Roman name for the mythological divinity whom the Greeks called Dionysus. (See Dionysus.)

BACH (*bäk*), JOHANN SEBASTIAN (1685-1750). By the light of the midnight moon a young boy sat copying from a great manuscript music-book spread before him. He strained his young eyes to see the notes, and stopped at times to stretch and rub his cramped little fingers; but he made no sound. The moonlight passed, and with a sigh the great book was noiselessly returned to its shelf. The copy was then carefully hidden and the little copyist crept to bed.

This 12-year-old boy was Sebastian Bach, an orphan. His brother, who was his guardian and music-master, had refused him the use of the book, telling him that its music was too difficult for one so young. But with a great music-love that would not be denied, the boy spent night after night secretly copying the coveted scores—working harm to his sight that resulted in blindness during his last years.

The whole life of this German musician was filled with incidents that show just such devotion to his art. When he was a choir boy he spent all his recreation hours at the organ or clavier. When he was able to fill the position of organist, he saved and scrimped, and traveled many miles on foot to hear and to study with the greatest organists of the day. In later years, although his duties as choirmaster in Leipzig made demands that might have kept two musicians busy, Bach found time to compose choral, organ, and piano pieces that were to become "the most universal force in the development of music." To the last days of his life, even when totally blind he dictated the choral, 'Herewith I Come Before Thy Throne', the passion for music governed his whole life. The 'Well-tempered Clavichord' was written for the instruction of his sons, and some of his finest cantatas were composed for his wife and daughter to sing.

In the musical life of Germany the name of Bach had long been known, and for six generations this family had furnished noted musicians. Sebastian Bach was recognized both as the greatest of all this musical line, and as one of the greatest organists and clavier players of the day.

In his time he was not generally known as a composer, and almost a hundred years passed before his music was widely published and appreciated. Now critics find no phrase too extravagant to describe the place his compositions fill in the literature of music. Bach has been described as "the man who suddenly

surpassed all that had been done before him, while at the same time anticipating all that was to be written in the future." The greatest of modern musicians have acknowledged their indebtedness to him.

Bach perfected the tuning of the clavichord, as the early piano was called, so that a new scale could be commenced on any note (*see* Music). Bach also was the first to teach musicians to use all five fingers in playing keyed instruments. His stately chorals and grand choruses have never been surpassed, and his orchestral music is remarkable for the richness of its harmonies. In Eisenach the house in which Bach was born has been made into a Bach Museum.

BACON, LORD FRANCIS (1561-1626). Next to Shakespeare, the greatest intellectual figure in the wonderful Elizabethan Age of England was Sir Francis



LORD BACON
Philosopher and Statesman

Bacon, who was made a peer under the titles Lord Verulam and Viscount St. Albans. Though a great philosopher, statesman, and jurist, Bacon was not always a great man. He showed at times some of the baser characteristics of human nature, including ingratitude (so it was charged) to his patron, the Earl of Essex; so that the poet Pope un-

justly styled him "the wisest, brightest, meanest of mankind."

By birth Bacon had many advantages. His father was Lord Keeper of the great seal of England, and so his boyhood was spent at Elizabeth's court. At 12 he entered Trinity College, Cambridge, but he remained there only three years, because he thought "the whole plan of education was radically wrong." He was next sent to France with the English ambassador, that he might learn "the arts of state."

His father's death for a time ended all hope of advancement at court. Cut off from the honors which he had hoped to gain, Bacon then turned his attention to law. He was admitted to the bar in 1582, and his success was immediate, for he was a convincing speaker and a sound lawyer. The poet Ben Jonson declared that "the fear of every man that heard him was lest he should make an end." Through the friendship of the Earl of Essex, Bacon won advancement at the court. In spite of writing that "There is no vice that doth so cover a man with shame as to be found false and perfidious," he later repaid the earl's kindness by helping to convict him of treason and to bring him to the block.

Bacon rose rapidly to the positions of attorney-general, privy counselor, and lord chancellor, in the latter position being head of the Court of Chancery as well as presiding officer of the House of Lords.

Students now recognize that he was one of the profoundest statesmen of that age, but the good advice which he gave King James I was usually disregarded.

In his published essays Lord Bacon gives this advice: "Seek not proud riches, but such as thou mayest get justly, use soberly, distribute cheerfully, and leave contentedly." But he himself was charged with receiving bribes in his court, and was impeached and convicted; he was sentenced to imprisonment and to pay an enormous fine, and was prohibited from afterwards holding a public office. Although Bacon proudly boasted that he had been "the justest chancellor that hath been" since his father's day, he confessed that his punishment "was just and for reformation's sake," because the old practices which he had carelessly followed were bad.

He was soon released from prison (after four days) and excused from paying the fine, but his exclusion from office continued in force. Cut off from his cherished career, he turned all of his attention to literary and scientific pursuits. He urged that in science men should reach their conclusions only by experimentation, and so is reckoned one of the founders of the modern "inductive" or scientific method of inquiry. His essays are full of shrewd, pithy, pungent observations, such as these: "He that hath wife and children hath given hostages to fortune"; and "Reading maketh a full man, conference a ready man, and writing an exact man." Bacon's life was finally sacrificed to his search for truth, for while testing whether snow would preserve meat he took a cold which proved fatal.

In the 19th century several writers sought to prove, on the strength of alleged "cipher" messages in Shakespeare's works, that Bacon wrote those immortal plays; but most students of literature were not convinced by the evidence.

Bacon's principal writings are: 'Essays' (1597); 'The Advancement of Learning' (1605); 'Novum Organum' (1620), explaining his philosophy; 'History of the Reign of Henry VII' (1622); and the 'New Atlantis' (1626), describing an ideal state.

BACON, NATHANIEL (1642-1676). Thoughtful students of American history see in "Bacon's Rebellion" of 1676 the spirit of the Revolution of a century later.

The Virginia colony at that time was so misgoverned by Sir William Berkeley, the tyrannical governor appointed by the English king, that the colonists burned with discontent, and the Indians grew bold to attack outlying plantations. When no official measures were taken to stop the Indian outrages, Nathaniel Bacon, a young lawyer who had emigrated from London to become a planter, organized his neighbors and punished the guilty tribes. The obstinate and treacherous conduct of Governor Berkeley caused the movement to broaden into a struggle of the democratic element among the colonists against the old aristocratic clique who supported the governor. In the course of the struggle Bacon burned Jamestown to the ground, and drove the tyrannical governor to take refuge on an English ship.

Soon after this, Bacon died suddenly and the rebellion collapsed. Governor Berkeley executed terrible vengeance on his foes, hanging more than 20 of them. King Charles II was emphatic in his disapproval of Berkeley, saying: "That old fool has put to death more people in that naked country than I did here for the murder of my father." The affair created a great stir in London, and secured more respectful attention to the needs and wishes of the American colonists.

BACON, ROGER (1214?-1294?). Three hundred and fifty years before Sir Francis Bacon revolutionized scientific method, the English friar, Roger Bacon, anticipated him in emphasizing the need of observation and experiment as the true basis of science.

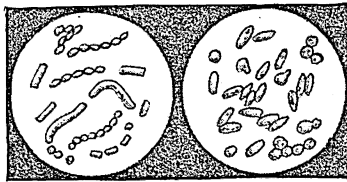
After studying at the universities of Oxford and Paris, Roger Bacon became a Franciscan friar and taught at Oxford. He was far in advance of the scholars of his day, for he was able to read both Greek and Arabic books in their original tongues. He believed that knowledge could be more certainly and rapidly advanced by experimenting with real things than by poring over the books of Aristotle. He knew something of gunpowder and the magnetic needle, and gave directions for constructing a telescope. He believed that the earth was round and that it was possible to reach Asia by sailing westward into the Atlantic. In one of his numerous writings he suggested the possibility of these modern inventions:

"Ships will go without rowers and with only a single man to guide them. Carriages without horses will travel with incredible speed. Machines for flying can be made in which a man sits, and skilfully devised wings strike the air in the manner of a bird. Machines will raise infinitely great weights, and ingenious bridges will span rivers without supports."

Is it surprising that to the Middle Ages Bacon's knowledge seemed the result of magic? Again and again he was ordered by his superiors to cease from his writing and teaching. But in Pope Clement IV for a time he found a friend who commanded him to set forth his views in a book.

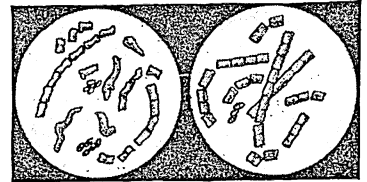
In spite of the jealousy of his brother friars and superiors, and the want of funds, instruments, writing materials, and copyists, Bacon now in 18 months produced three great books ('Opus Majus', 'Opus Minus', and 'Opus Tertium'), which he sent to the pope. After Clement's death, Bacon again fell into difficulties as a result of his attacks on the scholars and learning of his day; and by order of the head of the Franciscan order he was imprisoned for 14 years (1278-1292). His death followed not many months after his release.

Because he was so far in advance of his time, it is only in our own day that Roger Bacon's true greatness, as one of the world's most original thinkers, has been recognized.



At top of first circle are sour milk bacteria; below, cream and butter makers. In second circle, makers of alcohol.

THE world is filled with these tiny microscopic plants, which are at once the greatest friends and the greatest enemies of mankind—clearing the earth of its dead animals and plants, aiding man in many of his industries, but also afflicting him with the deadliest of his diseases.



In the first circle are the microbes that make vinegar; in the second, the microbes that make cheese.

The GOOD AND ILL that BACTERIA DO

BACTERIA. Nature is in a constant state of change. Life is produced and destroyed, and the chemicals in the world's workshop are continually combining into higher forms which make the bodies of plants and animals, and then breaking down again into the simple elements which form the air, the soil, and the rocks. The little creatures called bacteria are the chief laborers in this great workshop, performing many tasks which man with all his science and ingenuity is unable to imitate.

For every living creature we can see on this earth, there are billions—too small for us to distinguish—of these bacteria. If we could turn our eyes into microscopes and observe the daily lives of these tiny beings, we should be astounded, not only by their vast numbers, but by the tremendous work they do.

Under the name of "germs" we know certain bacteria as agents of disease (see Germ Theory of Disease). But by far the greater number are not only harmless but absolutely necessary to man's welfare. No other living things perform such valuable labor as these active bits of vegetable life—for bacteria belong to the vegetable rather than the animal world. It was not until the middle of the 19th century that their services, as well as their harmful effects, were recognized by scientists. Today the science of bacteriology is one of the newest and most important branches of our knowledge.

Bacteria which Act as Scavengers

Decay and decomposition in the bodies of plants and animals is caused by bacteria. When a wild creature dies in the woods, its carcass soon disappears, returning to the soil the materials of which it is composed; this "putrefaction" is the work of bacteria.

When a tree falls to the ground, it is compelled to yield up again the life-giving substances it can now no longer use; this rotting is the work of bacteria. Why is it that the great garbage dumps, still found near some cities, do not keep on increasing in size until they afflict the whole community with their unwholesome influence? Because vast armies of bacteria are

at work night and day cleaning up the refuse, reducing it to good soil and clean air again. Nothing can escape these scavengers, for they are in the air, in the ground, in the water—everywhere that life is found.

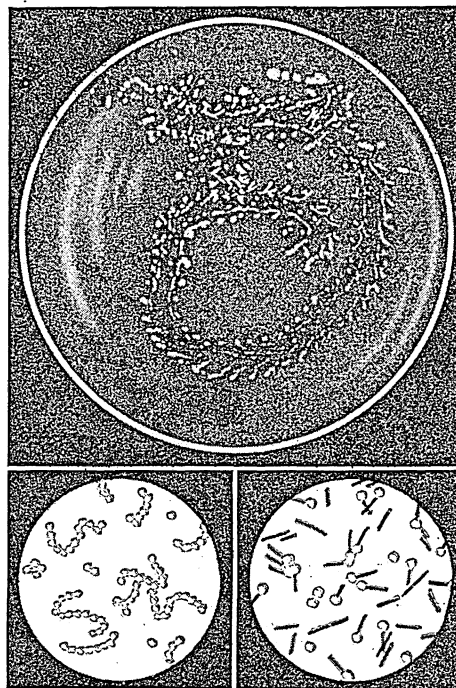
All processes of fermentation are due to bacteria or their cousins the *fungi*. Bacteria turn milk sour and thus give us buttermilk and the fermented milks such as kumiss and acidophilus milk. They play an important part in the manufacture of cheese and "ripened cream" butter. They turn wine, cider, and malt into vinegar. They act on corn mash to produce acetone and butyl alcohol, two solvents of great industrial importance. The latter is used in the manufacture of pyroxylin lacquers.

But their most important work is in the field of agriculture. Here they solve one of nature's greatest problems. All plants need nitrogen to build their living cells. The greatest source of nitrogen is

the air, but the pure nitrogen of the air is a stubborn and unsociable substance, which is unwilling to combine with other substances. Most plants are unable to seize and use it. But certain bacteria, especially a kind called *azotobacter*, can absorb and fix it in forms on which other plants can feed. Some nitrogen-fixing bacteria grow on the roots of legumes, such as alfalfa, clover, and peas (see Nitrogen).

But nitrogen is not the only substance that is

HOW BACTERIA MULTIPLY



A few hours after a fly walks over gelatin, colonies of bacteria appear wherever the fly stepped, as shown at the top. Below, left, the round pus cocci, which multiply by breaking apart, and right, the rodlike bacilli of lockjaw (*tetanus*), reproducing by means of spores.

handled by bacteria for man's benefit. Carbon dioxide gas is extracted by them from the cellulose fiber of dead plants washed into the mud of marshes and pools. This gas is then returned to the atmosphere, where with the aid of sunlight the plants can again use it to produce carbon for themselves and oxygen for animals and men.

In the process of putrefaction (decay) bacteria set free hydrogen sulphide—the gas that gives rotten eggs their odor. Another set of bacteria, in another place, may seize this gas and convert it into sulphates. About volcanoes there are bacteria which can act upon raw sulphur, forming sulphuric acid. Such bacteria, which can live upon inorganic chemicals, are called "autotrophic" (self-nourishing) bacteria. They are important in distributing the chemical elements over the earth. Deposits of iron ore were formed by the activity of autotrophic iron bacteria, it is believed.

Certain bacteria are luminous and produce the luminescence seen in decaying flesh and some forms of ocean life. Others cause spontaneous combustion in haystacks.

Bacteria in the Service of Man

Bacteria perform many other useful services in addition to those previously mentioned. They assist in the preparation of some hides and skins for use as leather, in the "retting" of flax so that the fibers may be separated, and in the treatment of sewage. So if some members of the group are harmful, we must remember that others are not only useful but necessary to our existence.

To describe bacteria, men had to invent a new unit of measurement, called the *micron*. This is one-thousandth of a millimeter in length, and it takes about 25,000 microns to make an inch. Most bacteria are about one micron wide and from one to seven microns long. This means that one thousand bacteria can lie side by side on the head of a pin.

Bacteria are of many shapes, but they fall generally into one of three classes: *bacilli* or rod-shaped bacteria, *cocci* or round ones, and *spirilla* or spiral and curled ones. Many bacteria are provided with *flagella*, hairlike projections, with which the speediest ones can travel about four inches in 15 minutes. They multiply very rapidly by splitting in two. Under good conditions a bacillus will reach maturity and split into two bacilli in 20 minutes; each of these will at once proceed to repeat this performance, so that within 24 hours billions of bacilli are produced from the original parent.

Some bacteria, instead of splitting into halves, change themselves into cells called "spores." These may develop at once into the full-grown bacteria; or, if conditions of moisture and temperature are not favorable, they may lie in the spore state for days or even years before springing into active life. In this condition they are capable of resisting great extremes of heat and cold. In fact, even full-grown bacteria have been known to live comfortably in water heated to 160° F., while others have recovered after being

frozen for days in liquid air, at a temperature of 418° below zero. The classification of bacteria is difficult. They are usually regarded as fission-fungi (*Schizomycetes*), related to the true fungi.

BADEN (*bä'den*), GERMANY. Just across the Rhine River from the French district of Alsace lies the German state of Baden. Its area, 5,819 square miles, is a little less than that of Connecticut and Rhode Island combined. Its population of 2,520,000 slightly exceeds that of those two states. Most of its surface is mountainous. It rises eastward from the Rhine to altitudes of more than 4,000 feet in the Black Forest. About two-fifths of all the state lies in this beautiful woods (see Black Forest). Rich farms occupy the narrow strip of plains along the Rhine.

The chief manufactures are toys, textiles, cigars, chemicals, machinery, pottery and jewelry. Pforzheim is especially famous for jewelry. The most important agricultural products are wheat, oats, barley, rye, potatoes, sugar beets, hops, and the grapes from which both red and white wine are made. Karlsruhe is the capital, and Heidelberg is the seat of the oldest German university. Mannheim, the largest city, is the chief manufacturing center and has a large river traffic. The mineral springs of Baden-Baden make it a famous health and pleasure resort.

In the Middle Ages, Baden was merely a group of feudal possessions, which continued to grow, little by little. The greatest additions were made during the Napoleonic era, when by fighting first on one side and then on the other the ruler won numerous concessions and was allowed to take the title of Grand Duke. According to the constitution of 1919, Baden was a republic. In 1933, however, this constitution was set aside and Baden was placed under the absolute rule of a governor appointed by Chancellor Hitler.

BADGER. In traveling over the prairies and plains of the Western states and Canada, you will be sure to see many a badger burrow. But unless you are lucky you may never catch sight of the badger itself, for

it is a timid animal and rarely comes out except at night. Even if you should surprise one away from its burrow, you might never notice it because of the extraordinary broadness and flatness of its clumsy body. When alarmed it sometimes flattens itself against the ground "like a doormat or a turtle"; and the long silky gray hairs, parted



From this picture, showing the Badger's broad flat body, you can form some idea of how he looks when he plays "doormat," and how hard it would be to find him in tall grass.

along the spine, spread out in the grass and blend with it so that the animal might be mistaken for a clod of earth or a stone.

But beware of the badger when it is cornered, for it will fight like "a stack of wildcats." A single badger is often a match for several dogs, and hence the cruel sport of "badger-baiting" was once common in England and the west of the United States. From this practise we get the word *badgering*, meaning

BEWARE OF THIS FELLOW!

"persistent annoying." The jaws are so hinged that dislocation is practically impossible, and hence they maintain their hold with great tenacity.

Badgers are found in the northern parts of Europe, Asia, and America. The head is pointed at the snout and the feet are armed with long claws used in digging

and for defense. The thick fur is valuable, and the hairs are used in the manufacture of artists' brushes.

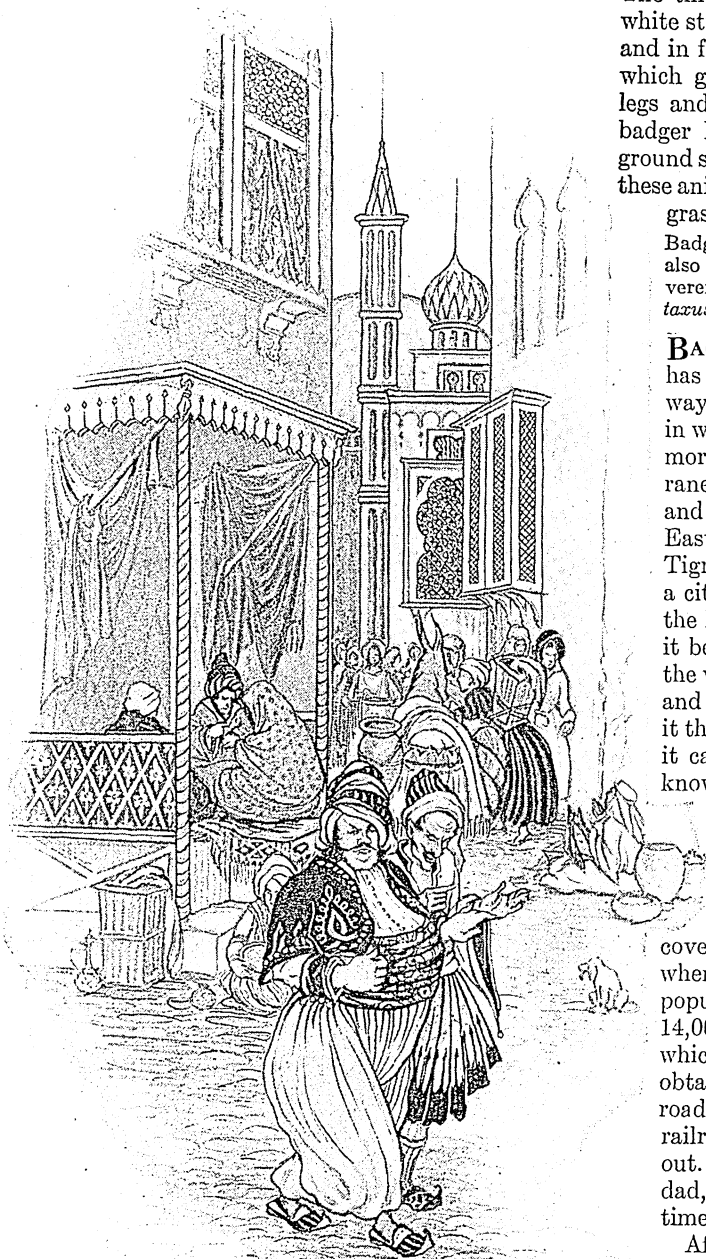
The American badger belongs to the West and shows a fondness for the open prairie, Wisconsin being known specifically as "the Badger State." It is about two feet long and grayish in color with irregular black bands on the back; underneath the fur is whitish. The throat and sides of the face are white, with a white stripe running from the nose over the forehead, and in front of each eye is a black patch, a marking which gives the face a clownlike appearance. The legs and feet are black. With its strong claws the badger lays open the burrows of the prairie dogs, ground squirrels, gophers, field mice, etc., feeding upon these animals and on birds, frogs, small snakes, lizards, grasshoppers, and other insects.

Badgers belong to the weasel family (*Mustelidae*), which also includes skunks, otters, minks, martens, and wolverenes. Scientific name of American badger, *Taxidea taxus*; European badger, *Meles taxus*.

BAGHDAD, IRAQ. For 4,000 years Baghdad has stood at the crossroads of great world highways of trade. The fertile plain of Mesopotamia, in which it lies, has been crossed since time immemorial by caravan routes connecting the Mediterranean ports with the Persian Gulf, and Turkey and southeastern Europe with Persia and the Far East. Where these routes met, on the banks of the Tigris River, 350 miles north of the Persian Gulf, a city grew up. After it was made the capital of the Mohammedan califs, in the 8th century A.D., it became the largest and most beautiful city in the world. The great calif Harun-al-Raschid, poet and scholar, contemporary of Charlemagne, made it the center of the world's art and learning. Hence it came to be called "The Glorious City." It is known to all lovers of romance as the scene of many of 'The Arabian Nights' tales.

Later the city suffered a long decline. Civil wars and repeated sackings by Mongols, Turks, and Persians humbled it; and when ocean routes around Africa were discovered, much of its trade was lost. By 1638, when it became a part of the Turkish Empire, its population had been reduced from 2,000,000 to 14,000. At the end of the 19th century Germany, which then hoped to dominate the Near East, obtained from Turkey a concession to build a railroad through Turkey to Baghdad. Before the railroad was completed the first World War broke out. In March 1917 the British occupied Baghdad, ending Turkish rule and ending also, for the time, Germany's "Berlin to Baghdad" dream.

After becoming the capital of the kingdom of Iraq in 1920, Baghdad entered a new and more prosperous era in its history. In 1940 the last link in the Berlin to Baghdad railway was completed under British auspices. An extension of the line terminated at the port of Basra on the Persian Gulf. The airport at Hinaidi is an air center



THE BAGHDAD OF THE 'ARABIAN NIGHTS'

of the Orient and the nucleus of a rapidly growing suburb. With modern transportation Baghdad is regaining its old standing as a center of trade between East and West.

Baghdad (also spelled Bagdad) is no longer the picturesque city of Harun-al-Raschid's time. A railroad station stands near the spot where that ruler built his beautiful palaces and gardens. The flat-roofed houses of sun-dried brick and the many ancient mosques still stand in a maze of narrow, winding alleyways. But the British in 1917 built a modern street straight through the city, and unromantically named it New Street. Other paved streets have followed; and street-cars, taxicabs, electric lights, a modern water system, and a museum of Mesopotamian antiquities speak eloquently of Western progress. Even the fascinating covered bazaars are invaded by the wares of Europe. The city's present population is about 360,000, one-fifth of whom are Jews, descendants of the people who were carried away into the Babylonian captivity by Nebuchadnezzar. (See also Iraq; Mesopotamia.)

BAGPIPE. This reed instrument has a long history. It is spoken of in the Old Testament and it was used by Egyptians, Greeks, and Romans. During the Middle Ages it was one of the popular instruments of the troubadours. Today it is the national instrument of the Scottish Highlanders, and pipers are attached to Highland regiments in the British army.

The Scottish Highland bagpipe has a large leather bag, inflated by the player's breath. Attached to the bag are the small pipe through which the player blows; pipes of fixed pitch (usually three) called drones, which sound continuously while the instrument is being played; and the "chanter" or "chaunter," a pipe with generally from six to eight finger holes on which the melody is played. The drones are fitted with single reeds, like the clarinet reed, and the chanter with a double reed, like the oboe reed. Other forms of the bagpipe are found in Brittany, Italy, and other countries. Some get the wind supply from a small bellows under the player's arm.

BAHAMAS (*bá-há'máz*). Columbus made this group of islands in the West Indies famous, for it was on one of them that he first touched the soil of the New World. Watling Island, the outermost of the group, was probably the one that Columbus discovered and named San Salvador.

The archipelago, which is a British crown colony, consists of about 3,000 low islands and rocks. These form a line 600 miles long reaching from a point off the east coast of Florida nearly to the island of Hispaniola (Haiti). Through this barrier there are but three channels for large vessels, for the islands are merely the exposed peaks of a great submarine mountain range. There are no running streams, except on Andros, the largest island. Fresh water is supplied by wells dug in the soft rock.

The climate is mild, with an average winter temperature of about 70° F. Nassau, the capital, on New Providence Island, is a popular winter resort. Fruits

and vegetables are grown. The chief exports are sponges, sisal, salt, tomatoes, and tortoise shell. The area of the 20 inhabited islands is about 4,400 square miles. Part of one of the southernmost, Mayaguana, was leased by the United States in 1940 for 99 years as an air and naval base to improve defense of the Caribbean. Population, 60,000, mostly Negroes.

BAIKAL (*bī-kāl'*), LAKE. With a depth of 5,400 feet, Lake Baikal in southern Siberia is the deepest fresh-water lake in the world. It is also the sixth largest. It is about 390 miles long and from 20 to 50 miles wide, with an area of 13,200 square miles. Ringed by the Baikal Mountains, a spur of the Altai Range, the lake is fed by countless swift streams. The largest is the Selenga River. The lake's chief outlet is the Angara River, which flows into the Yenisei. *Baikal* means "rich lake," and it abounds in fresh-water seals, sturgeon, salmon, and herring. It bears considerable trade—in "open weather," in steamships; and when the lake is frozen, over the ice.

BAKING POWDER Just as yeast raises bread by producing bubbles of carbon dioxide in the dough, so baking powder performs the same service in preparing biscuits, cakes, and other quickly made breads. The two methods of leavening differ in that yeast works slowly by fermentation resulting from the "breathing" of tiny plants (see Yeast), while the bubbling caused by baking powder is the result of a rapid chemical reaction between the alkali and the acid-producing ingredient of the powder.

The alkali is always bicarbonate of soda, which is ordinary baking soda. The acid-producer may be cream of tartar (potassium bitartrate), or an acid phosphate such as monosodium phosphate, or a compound of the alum group (see Alum). In the so-called "alum baking powders," the harmfulness of which has been disputed, plain aluminum sulphate and not alum is now the usual ingredient. Used in the moderate quantities required for good baking, no standard baking powders leave in the finished products chemical residues that are likely to be injurious.

The manufacturer mixes the soda and the acid-producer together dry, sometimes with a little starch or flour as a filler to prevent premature action. The moisture of the batter or dough causes the chemicals to combine and form gas bubbles.

Instead of baking powder, cooks sometimes use soda and sour milk. These form gas bubbles by the action of the lactic acid in the milk.

BALBO'A, VASCO NUÑEZ DE (1475-1517). On Sept. 25, 1513, the Spanish explorer Balboa beheld from the top of a mountain in Panama the gleaming waters of the western ocean—

... when with eagle eyes,
He stared at the Pacific—and all his men
Looked at each other with a wild surmise—
Silent, upon a peak in Darien.

He was the first European to look upon the waters of that mighty ocean, and the first to cross the Isthmus of Panama.

Balboa was a Spanish adventurer who had unsuccessfully tried farming in San Domingo. When he left that settlement in 1510 to join an expedition to Darien, he had himself taken on board ship in a cask labeled "victuals for the voyage," in order to avoid his creditors. When he gained control of the colony of Darien he started on his explorations in order to keep the favor of the Spanish king; and for him he claimed the "South Sea," as he called the Pacific, and all lands washed by it. He was too late, however, with his peace offering, for when he returned to Darien he found that a new governor had been appointed in his place. Friction between the two developed immediately, and as the governor had the power in his hands, he threw Balboa into prison. Later he had him beheaded for stirring up a rebellion.

BALDER (*bal'dēr*). Among all the gods of Norse mythology there was none so beloved and beautiful as Balder, son of Odin. When he passed it was like the coming of sunshine, and every grief fled before the brightness of his presence. In all his life he had never known a moment of sadness, and the gods vied with one another in showering favors upon him.

One night his sleep was haunted with dreams of dire disaster. When the gods learned of this, sorrow fell upon them. His mother Frigga, heartbroken, roamed the earth, supplicating all living things not to harm her son, and they willingly gave their promise. The gods thereupon rejoiced and happiness reigned in Asgard, their habitation. Thenceforth Balder led a charmed life, and on festival days the gods hurled missiles in play at the invulnerable hero, who smiled when darts and stones fell harmless at his feet.

But among the gods was one selfish, jealous being named Loki, who wished to put an end to Balder's reign of love. Disguising himself, he sought out Frigga and obtained from her the admission that there was one frail little plant, the mistletoe, whose promise of protection to Balder she had neglected to get. It was so small and so hidden in the oaks of the mountainside that she had failed to visit it.

When he learned this, Loki made a spear shaft out of the oldest, toughest sprigs of mistletoe. Hoder, a blind god, loving Balder and wishing to honor him, consented to throw the shaft, not knowing that it alone of all things was harmful to the beautiful god. Balder fell, pierced to the heart, and his spirit journeyed to the underworld. Sorrowing, the gods pleaded for the release of Balder. The ruler of the underworld consented, provided that every living thing should weep for his return. The whole grief-stricken world immediately began to weep, with the exception of the hateful Loki. So Balder could not be released, and he has dwelt in the underworld from that day to this.

A tiny, aster-like flower with pure white petals, which grows everywhere by the roadside, is called in his honor, "Balder's brow." In the Norseland when the dark long winter sets in the people say, "All nature sorrows for Balder." And when the spring breaks forth with budding trees they cry, "The spirit of Balder again roams the earth."

BALDWIN, ROBERT (1804-1858). That Canada is today a loyal and contented member of the British Empire is due in large measure to the far-seeing political wisdom of Robert Baldwin.

Elected to the legislature of Upper Canada in 1829, four years after he began the practice of law in his native town of York (now Toronto), Baldwin came to the front as a champion of responsible government. He insisted that Canada should have a system of cabinet and parliamentary government like that of England, with a legislature elected entirely by popular vote. However, he had no sympathy with the extremists who launched the ill-fated rebellion of 1837-38. (See MacKenzie, William L.; Papineau, Louis J.)

Twice Baldwin was called to the Executive Council, in 1836 and 1841, only to resign on questions involving the principle for which he was fighting. At last, in 1842, after the union of Upper and Lower Canada, he formed, with Louis Hippolyte LaFontaine, the first administration to accept responsible government. Disagreement with the governor-general soon led to their resignation; but in 1848 Baldwin and LaFontaine were again returned to power, and the principle for which they had fought so courageously was finally established. When in 1851 the radical wing of his party gained the ascendancy, Baldwin, always a moderate, resigned. The rest of his life was devoted to bringing about a better understanding between the English and the French sections of Canada.

BALDWIN OF BEWDLEY, EARL (born 1867). Described as the "most thoroughly English Englishman," Stanley Baldwin was honest, direct, and unimaginative. He was also capable of shrewd and decisive action in a crisis, and his countrymen turned to him time and again when they wanted a Conservative leader of practical ability and strong common sense.

Baldwin was born in the small town of Bewdley, of sturdy Puritan stock. After his education at Harrow and Cambridge he went into business in the family iron and steel works, of which later he became virtually head. The artists Burne-Jones and Edward Poynter were his uncles by marriage, and Rudyard Kipling was a cousin. Thus Baldwin naturally acquired a love for the best in literature and art. Extremely fond of outdoor life, he became a typical "English country gentleman."

He was elected to Parliament in 1908 and after nine rather uneventful years became parliamentary secretary to A. Bonar Law, leader of the Conservative party. From 1917 to 1921 he was financial secretary to the treasury. In 1921 he became a member of the cabinet as president of the Board of Trade. In 1922, when Bonar Law became prime minister, Baldwin was made chancellor of the exchequer. In this office he headed the mission to the United States which made an arrangement for the payment of the British war debt. When his chief resigned because of failing health, Baldwin succeeded him as prime minister. After a few months Baldwin's ministry was forced to give way to that of the Labor party, but in less than a

year he returned to the premiership, which he held for more than five years. When the general strike of 1926 paralyzed industry, he handled the difficult situation in a way which was approved by most of the British public. In 1931 when the National coalition ministry was formed, with Ramsay MacDonald as prime minister, Baldwin as leader of the Conservative party became a member with the office of lord president of the council. When MacDonald resigned in 1935, Baldwin became prime minister.

One of his important acts was to launch a vast rearmament program. But most notable was his handling of the abdication crisis of 1936 (see Edward, Kings of England). After forcing Edward VIII to abdicate, he rallied most of the English people in support of the Duke of York, who became king as George VI. After the coronation in May 1937, Baldwin resigned. The new king then honored him by making him an earl.

BALEARIC (*bäl-ē-är'ik*) **ISLES.** This group of islands lies off the Mediterranean coast of Spain, to which it belongs. The five largest are Majorca (or Mallorca), Minorca, Iviza, Formentera, and Cabrera. The climate is generally mild, and many tourists are attracted, especially to Majorca. Palma, on this island, is the largest city.

Port Mahon, in Minorca, is one of the finest harbors in Europe. Almonds are among the most important products. Vines, olives, and fruit trees are abundant.

In ancient times subject to Carthage, then to Rome, the islands became an independent kingdom in the 13th and 14th centuries. The natives, who were famous slingers, were named *Balears*, from the Greek *ballein*, meaning "to throw." Area 1,935 square miles; population, about 330,000.

BALKAN (*bäl'kän*) **PENINSULA.** The "wild west" of America, where once Indians, cowboys, and bandits made life picturesque but uncertain, has vanished. But in the Balkan Peninsula, the people are still for the most part living in a way that reminds us of this bygone epoch of American life. To the traveler, this peninsula with its variety of peoples and customs is a land of romance and historic interest. To the statesman, it has long been "the firebrand of Europe."

The Balkan Peninsula is the easternmost of the three southern peninsulas of Europe. Its northern limit is fixed by the Danube and Save rivers and the Transylvanian Alps. On the east, at the Dardanelles and the Bosphorus, it approaches so closely to Asia that it forms a bridge between the two continents. On the west it looks across the Adriatic to Italy, whose

interests and ambitions now parallel, now oppose, those of the Balkan peoples.

For the most part the peninsula is wild and mountainous. It contains rich and varied mineral deposits, which are still almost untouched because of the backwardness of the region. Running westward from the Black Sea are the lofty and rugged Balkan Mountains, from which the peninsula takes its name. These soon split up into other ranges, one of which—the Pindus

Mountains—extends to the southernmost tip of Greece. The peaks range from 3,000 to 10,000 feet in height. North of the Danube River lie the plains of Rumania, which geographically are an extension of the plains of Russia rather than part of the Balkan Peninsula, but politically Rumania belongs with its neighbor states to the south. In this plain large crops of wheat can be raised, but in the rest of the Balkans the inhabitants gain only a bare living from the soil by a primitive agriculture.

The backwardness of the inhabitants is due largely to the isolating effect of the mountains, which separate them from one another and from the rest of Europe. In this comparatively small territory there are probably more different peoples with separate languages, customs,

national aspirations, and religions than in any other equal area in the world; and nearly all these groups are scattered widely over the peninsula.

Some of the oldest historic races are represented. The Albanians, for instance, are believed to be descended from the ancient Illyrians, who probably came into the peninsula about 3,000 years before the birth of Christ. The Greeks trace their history to the days when Greece was the center of the world. The Rumanians recall in their name (from Rome) the days when their ancestors were sent out by the Roman emperor to guard the border of his empire. The numerous Slavs are comparative newcomers. There are also other stocks, such as Turks and Armenians.

The population of Macedonia, consisting of Slavs, Turks, Greeks, Albanians, and Kutzo-Vlacks, has created perhaps the most dangerous of the Balkan problems. This region was divided among Greece, Yugoslavia, and Bulgaria by the treaty of Bucharest in 1913, and there has been continued agitation since for an autonomous Macedonia. Bitter political strife between the Croat and Serb factions in Yugoslavia has been another source of continued uneasiness.



STANLEY BALDWIN

THE MOUNTAINS WHERE THE WAR CLOUDS GATHER



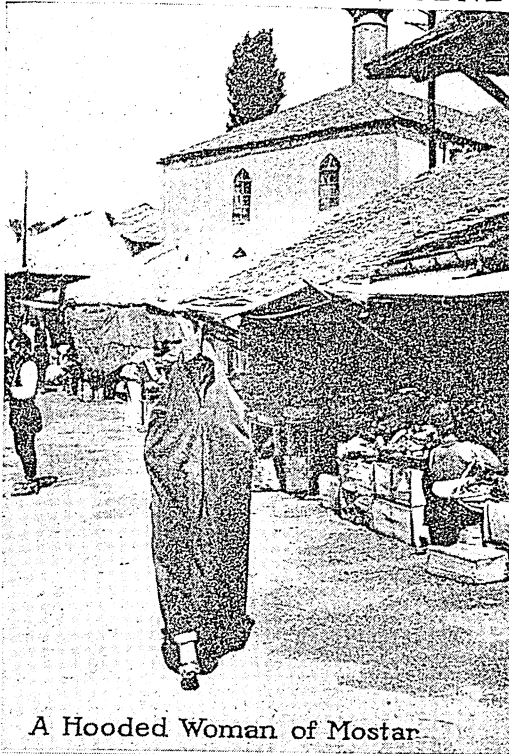
Mountains which cut up a land into small sections cause the formation of "war clouds"—in the Balkans, at least—as naturally as mountain peaks gather clouds that bring the rains. The Balkan Peninsula has been the scene of constant wars ever since the days of the Greeks.

Before the World War the principal nations here were Rumania, Serbia, Montenegro, Albania, Greece, Bulgaria, and Turkey. The new frontiers solved some old problems, but created new ones. In some instances large groups of people found themselves just outside the frontiers of their former states. In the rearrangement of frontiers after the war, this mixed popula-

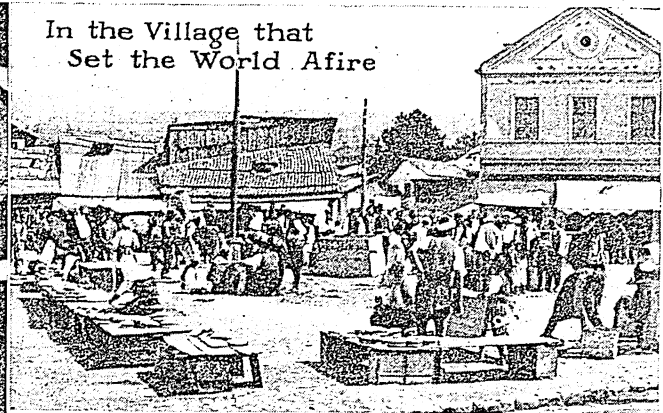
tion was divided into six nations—Albania, Bulgaria, Greece, Yugoslavia, Rumania, and Turkey. Provisions were made for protecting minority groups within the various nations.

Only at rare intervals has the whole peninsula been united under one government. For example, it all formed part of the Roman Empire in the days of

FAMILIAR SCENES IN THE BALKAN LANDS



A Hooded Woman of Mostar

In the Village that
Set the World AfireA Slovak
Freight Car

The Women in the Fields

Men's Fashions
in the Balkans

No one who tours the Balkan countries will fail to remember the market place in Sarajevo (Bosnia), the town in which the Austrian crown prince was assassinated, thus bringing on the World War; nor the women reaping in the fields; nor the quaint costumes of the peasants in some districts. Where the Mohammedan faith prevails the women never appear in public without their long robes that shroud them from head to foot and with heavy veils over their faces.

the supremacy of the City of the Seven Hills. But when the barbarian invasions began, in the 4th century, the Balkan Peninsula was the first part of the empire invaded. Successive waves of Visigoths, Ostrogoths, and other peoples came into the country, but were pushed on farther west by the hordes of Slavs pressing upon them from the north. Then came the Turkish invasion. In 1453 Constantinople fell, and the Turkish power was soon established up to and beyond the Danube.

In the 19th century came the gradual redemption from Turkish rule. In spite of frequent uprisings, it was not until 1830 that Greece managed, with the aid of the western European nations, to gain her independence. One by one the other Balkan nations freed themselves, until now Turkey holds in Europe only a small part of its former possessions.

A number of Balkan wars accompanied this break-up of the Turkish Empire. In 1828-29 Russia aided

the Greeks to win their independence. Twenty-five years later the Russian demand for a protectorate over all Christians of Greek faith residing in Turkey precipitated the Crimean War (1854-56) in which Great Britain, France, and Piedmont came to the aid of Turkey and defeated Russia. The troops of the Czar intervened a third time, in 1877-78, to aid the revolting Serbians and Bulgarians against the Turkish policy of massacre; but the Peace of San Stefano, which Russia forced upon Turkey, was set aside by the other powers in the Congress of Berlin in favor of one much less favorable to the oppressed Christian peoples.

Russia's interest in the Balkans was traceable chiefly to her desire to obtain possession of Constantinople and other parts of the inheritance to be left by the "sick man of Europe" as the Czar once called the decaying power of Turkey. For over a century the game of intrigue and war over the "New East" went on, the other powers of Europe interfering at times to aid the subject peoples in their revolts, and at times to block Russia's plans. Then Austria began to dream ambitious dreams of eastward extension—the *Drang nach Osten*—and these gradually linked up with Germany's far-reaching plan for a Berlin-to-Bagdad railway and a "Middle Europe" under Teutonic control, in which the Balkans should be their "corridor" into Asia.

Many calculations were upset when, in 1908, the "Young Turks" seized the government of Turkey, and sought to restore the "sick man's" waning vitality. Austria made

haste to annex Bosnia and Herzegovina—two Turkish provinces which she had administered for some time—and Bulgaria declared its complete independence. Bulgaria, Serbia, Greece, and Montenegro formed a Balkan League and in October 1912 declared war against Turkey. Forced in six months' time to ask for peace, Turkey in May 1913 signed the Treaty of London, limiting its territories in Europe to a strip around Constantinople. Bulgaria then engaged in a disastrous war with the other Balkan countries, and by the terms of the Treaty of Bucharest (signed in August 1913) was forced to cede territory to Serbia and Greece.

In the World War of 1914-18 Turkey and Bulgaria joined the Central Powers and suffered further losses of territory by the peace settlement. Turkey, however, regained some of its old lands by the Treaty of Lausanne (1923) following a brief war with Greece.

In 1920-22 Yugoslavia, Rumania, and Czechoslovakia formed the Little Entente to keep their frontiers intact. In 1934 Rumania and Yugoslavia joined Turkey and Greece in a Balkan Entente. These efforts to insure the *status quo* proved ineffective, however, when Germany under Hitler began its drive to the east. In 1938-39 Germany absorbed Czechoslovakia, destroying the Little Entente, and extended German economic control in the Balkans. In April 1939 Italy conquered and annexed Albania.

The fascist nations completed their conquest of the Balkans during the war in Europe. Rumania, first to be dismembered, in 1940 lost territory to Russia, Hungary, and Bulgaria. Then German troops occupied the country. In October Italy invaded Greece, but the Greeks drove back the Italians. Germany meanwhile won Bulgaria to its side and sent troops into the country (March 1941). Then, in April, the Germans launched an offensive against Greece as well as Yugoslavia, which had also resisted fascist demands. Despite the aid of British troops, these small Balkan nations were quickly overrun. (See World War, Second; Macedonia, also articles on separate Balkan countries; and Balkan Peninsula in Fact-Index at the end of this volume.)

—REFERENCE-OUTLINE for Organized Study of the BALKAN STATES—

THE COUNTRIES lying in the Balkan Peninsula and in the region north of it have been known historically as the Balkan States. Not only their boundaries, but their number as well, have frequently changed as successive wars have swept through the region. Their strategic geographic position, their racial differences, and the existence of national minorities in all the states have made their history a tale of strife and tragedy. Successive invasions and migrations, which began before the dawn of history, have left many different peoples in the isolated mountain valleys—peoples who have kept their ancient traditions and their national loyalties.

The Balkan States are wedged in between Russia, Germany, and Italy. They lie on the main land route between Europe and Asia and on the Mediterranean Sea. At the Dardanelles and the Bosphorus, within Turkish territory, Europe and Asia almost touch. Through those narrow straits shipping between Black Sea ports and the outside world must pass.

Their position and their valuable resources make the Balkans important to the great powers. The jealousies and rivalries aroused by the Balkan Wars led directly to the World War of 1914-18. The peace settlements established a fair degree of stability under the leadership of Great Britain and France. But this order was swept aside after 1939, when a new European war brought the Germans and Italians to a dominant position throughout most of the Balkans.

I. YUGOSLAVIA: Y-212. This state, created after the first World War, consists of what formerly was Serbia (S-80),

Montenegro (M-247), Bosnia and Herzegovina (B-198), and other lands on the Adriatic previously belonging to Austria-Hungary, including Croatia and Slavonia, and most of Dalmatia (A-381). The northern boundary extends into the Hungarian Plain (H-360).

A. Physiography: Y-212, M-247, B-17, B-18 (map).

a. Mountains: All of Yugoslavia, except the northern strip of Hungarian Plain, is covered with rugged forested highlands and mountains including the Dinaric Alps, which form a link between the Alps proper in the west and the Balkan ranges in the east (E-318).

b. Lowlands: The strip of Hungarian Plain includes the valleys of the Save and the Drava and a rich part of the Danube Valley (D-14).

B. Climate: The climate, particularly on the southern mountain slopes, is mild. Extremes of cold are found only in the highest interior ranges. Rainfall is plentiful along the coast and in the foothills to the north, but scanty in some of the inclosed table-lands.

C. Resources and Products: Y-213, S-81, B-198.

D. Area and Population: Y-212.

E. Chief Cities: Belgrade, capital (B-90); Agram or Zagreb (see Fact-Index).

F. The People: Y-213, S-162, B-17.

G. The Fiume Dispute: F-82, W-174.

H. Conquest in Second World War: Y-212, W-178g.

II. RUMANIA: R-174.

A. Physiography: See map, B-18.

a. Mountains: Southern spurs of Carpathian Mountains, including Transylvanian Alps (C-86, R-175, E-318).

b. Uplands of Transylvania West of Mountains: R-175.

c. Strip of Hungarian Plain on Western Border.

- d. Lowland Plain in Southeast Comprising Lower Danube Basin and Stretching to Black Sea: R-175, E-318.
- e. Rivers: Danube (D-13) and its tributaries the Pruth and Sereth (B-18, map).
- B. Climate: Mountains and western slopes have typical Central European climate; eastern plains suffer from extremes of heat and cold (R-175).
- C. Resources and Products: R-175, B-17, E-318.
- D. Area and Population: R-175.
- E. Chief Cities: Bucharest, capital (B-257); Jassy (Iasi), Constanta (Kustenje), Galatz (Galati), Braila: R-176.
- F. Language: R-128.
- G. Balkan Wars: B-20.
- H. Area More Than Doubled as Result of First World War: R-174, W-160.
- I. Turbulent History after the War: R-176, B-20.
- J. Territorial Losses in 1940: R-175, W-178g.
- K. Joins Germany in Attacking Russia: W-178r.
- III. BULGARIA: B-269.
- A. Physiography: B-269-70, B-17. The Balkan Mountains lie across the middle of Bulgaria from west to east. To the north is a lowland plain formed by the Danube River (D-14). Highlands surround a strip of plain on the Black Sea (B-154). Maps: B-18, E-326c-f.
- B. Climate: Generally mild with cold winters in mountains.
- C. Resources and Products: B-269-70.
- D. The People: S-162, B-17.
- E. Balkan Wars: B-20.
- F. Bulgaria in World Wars: B-271, W-157, W-164, W-174.
- IV. ALBANIA: A-107.
- A. Physiography: A-107. Rugged mountains encircle a narrow strip of coastal plain. Maps: B-18, E-318-19.
- B. Climate: Extremely mild, except in the highest mountain regions where the winters are quite severe.
- C. Area and Population: A-107.
- D. Chief Cities: Durazzo; Tirana, capital; Scutari or Shkodra (see Fact-Index).
- E. The People: B-17, G-164.
- V. GREECE: G-153.
- A. Physiography: See map, B-18.
 - a. Mountains and Plains: G-153. All of Greece is criss-crossed by ranges of low mountains and hills, with

small valleys and plains between. The Pindus range (B-17) is the most important.

- b. Coast Line: G-153. Countless gulfs and peninsulas, among which the most important are the Gulf of Corinth (C-364) and the Peninsula of Morea (G-153).
 - c. Surrounding Islands: Crete (C-394); Aegean Islands, Sporades and Cyclades (G-156, B-18, map); Ionian Islands (B-18, map).
 - B. Climate: G-154. Temperate, with moist winters and dry summers.
 - C. Resources and Products: G-153, G-164, C-394.
 - D. Area and Population: G-153.
 - E. Chief Cities: Athens, capital (A-353); Saloniki (S-14); Piraeus, port of Athens (A-353).
- (Note: For the study of the early history of Greece, consult the Reference-Outline on Ancient History: A-193.)
- VI. GENERAL BALKAN HISTORY.
- A. Why the Balkans Hated Turkish Rule: B-20, S-80.
 - B. Russian Aggression in the Balkans: B-20, S-81.
 - C. The Revision of the Treaty of San Stefano by the 1878 Congress of Berlin: B-20, T-164, D-71, S-81.
 - D. The Nature of the Near East Question: M-5, B-20.
 - E. The Balkans and the First World War: W-149, B-20, Y-212, M-5, R-174.
 - F. Albania Seized by Italy: A-107.
 - G. Second World War: W-178p-r, B-271, G-163, R-175, R-176, Y-212.

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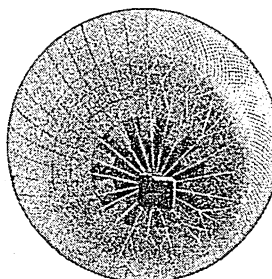
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FLYING GAS-BAGS *from* MONTGOLFIER *to* ZEPPELIN

BALLOON. On June 5, 1783, a large crowd was assembled in a field near Annonay, France, in the center of which stood a pile of straw and a mass of linen cloth supported on a frame. Presently fire was set to the straw and slowly the cloth swelled into the form of a huge bag, as the hot air and smoke ascended into it. When fully inflated it was let go. The bag rose rapidly to a great height, remained in the air ten minutes, and descended a mile and a half away. The credit for this first balloon ascent in history—though without a passenger—belongs to two brothers named Montgolfier, the sons of a wealthy paper manufacturer.

For 4,000 years men had known how to weave cloth, and ever since fire was discovered they had known that smoke ascends. They had the materials for balloons; all they needed was the idea. Joseph Montgolfier was the first man in history to conceive the idea of "harnessing smoke" by confining it in a bag.



On August 26 of the same year, J. A. C. Charles, a noted French scientist, sent up from Paris a bag of varnished silk, 13 feet in diameter, filled with hydrogen gas. It rose 3,000 feet and traveled 15 miles into the country. There the terrified peasants, believing it to be an evil spirit, fell upon it with pitchforks and tore it to pieces. This was the first gas balloon.

The first living passengers in a balloon went up on Sept. 19, 1783, at Versailles, in a Montgolfier model. They rose to 1,500 feet and descended eight minutes later in a forest two miles away. The passengers were none the worse for the trip, except that one of them had kicked another severely. The cause of the quarrel was never explained, for these first of all aeronauts were a sheep, a rooster, and a duck.

The first human being who tempted fate in the clouds was Jean Pilâtre de Rozier, a native of Metz, Lorraine. He went up in a hot-air balloon on Oct.

15, 1783, near Paris. The balloon was "captive," being fastened to the ground by a long cable. Five weeks later, on November 21, De Rozier and the Marquis d'Arlandes soared from the ground without a cable, the first men to navigate the air in freedom. They remained up 25 minutes, drifting about five miles with the wind.

Ten days later, Charles made the first ascent in a gas-filled balloon and stayed up about two hours. For a time hot air and gas balloons developed side by side. The former rose because the expanded hot air in the bags was lighter than the outside cold air. When the hot air cooled they had to come down. Before long, fire balloons were carrying furnaces under the bags to keep the air hot. While fuel lasted the balloonists could stay aloft; also, they could control rise and fall by regulating the furnace. But the ultimate advantage lay with gases that at equal temperature are lighter than air: coal gas, for example, and, best of all, hydrogen, which is 14 times lighter than air. Gas balloons were not only stronger and steadier in lifting power but also were more easily controlled. Sand ballast that could be poured overside and a valve to release gas at will governed their rise and fall.

Ascents into the Stratosphere

As soon as the balloon was sufficiently improved, scientists began to use it to study the changes in temperature and pressure in the upper air. For this purpose, Prof. A. Berson and Dr. R. J. Süring of Berlin, Germany, rose on June 30, 1901, to 35,440 feet. Even though they took oxygen tanks with them, they were unconscious during part of their trip. Capt. Hawthorne C. Gray, of the United States Army, set a new record of 42,470 feet in May 1927. On a flight the following November he accidentally cut his oxygen tube and died in his balloon. His instruments recorded a height of 44,000 feet.

On May 27, 1931, Prof. Auguste Piccard of Brussels University rose to 51,790 feet, and on Aug. 18, 1932, to 53,153 feet. He used an airtight aluminum sphere or gondola, equipped with oxygen tanks, attached to a huge balloon. Later ascents, one after another, bettered this record, up to the record of 72,395 feet above sea level set by Capt. Albert W. Stevens and Capt. Orvil A. Anderson on Nov. 11, 1935, in an ascension made from Rapid City, S. D.

Scientists make such flights in order to study cosmic rays (see Light; Radiation) and other phenomena within the stratosphere. This region, encountered at a height of six to eight miles above the earth, is an

intensely cold, cloudless layer of rarefied air where the temperature remains practically constant, not decreasing with height. Above it is the Kennelly-Heaviside layer which reflects radio waves; below is the troposphere, the belt of ordinary air in which life exists. In the stratosphere itself the temperature is from 50° to 70° F. below zero; the air pressure is only 1/250th of what it is at sea level.

Aside from such scientific findings, the various stratosphere ascents showed how men could be kept alive and comfortable at such heights. This helped in developing the so-called "stratoplane" (see Airplane). Further, the information gained about conditions in the upper air helped in making weather forecasts (see Weather Bureau).

The Radiosonde

The use of sounding balloons and instruments to obtain this information for regular forecasts was developed in the United States between 1935 and 1939 by the government, Harvard University, and several private agencies. The complete unit, called a *radiosonde*, has a lifting balloon, a parachute, and instruments. It rises until the balloon bursts at about 50,000 feet above sea level. (The record experimental height is 155,800 feet, about 29½ miles.) The instruments are then parachuted down to earth.

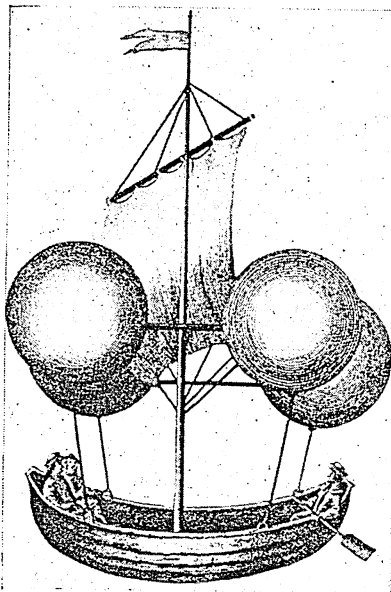
The instrument case contains a thermometer, a barometer, and 16-strands of human hair which contract or stretch according to relative humidity. A mechanism driven by clockwork takes readings every five seconds from these instruments, and transmits them to the ground by radio as the radiosonde rises.

Early Travels with Balloons

The early round balloon was unsatisfactory for travel, because it floated wherever the wind went; but great distances have been covered in it. One of the longest trips was made by Hans Berliner, who with two companions sailed 1,897 miles from Germany to a point in the Ural Mountains of Russia (Feb. 8 to 10, 1914). Explorers expected much aid from balloons until the tragic disappearance of Salomon A. Andrée, a Swedish scientist who set out July 11, 1897, from Spitzbergen, hoping to reach the North Pole, 600 miles away. A carrier pigeon and floating buoys brought messages for some days; then nothing more was heard for 33 years, until in 1930 the bodies of Andrée and his aids and remains of their camp were found on White Island by Norwegian explorers.

During the Civil War in America captive balloons were used to some extent by the Union armies for observation, and during the siege of Paris, in the

A BOAT TO SAIL THE SKIES



This is the idea of a lighter-than-air machine set forth by Francis Lana, a Jesuit, in 1670. His project was to get lifting-power by exhausting the air from very thin copper globes, and to use a sail for propulsion.

Franco-Prussian War of 1870-71, many messengers were sent out of the imprisoned city by balloons. The chief difficulty was the lack of means for controlling the direction of flight, and modern science set itself to the task of solving this problem.

Balloons that Can Be Steered

The first effort to propel and steer a balloon by artificial means seems laughable to us today. The balloonists took up huge oars of cloth-covered framework and tried to row the big gas bag as you would row a boat on a lake! In 1852, however, Henri Giffard installed a light steam engine in the car of a cigar-shaped balloon, and achieved near Paris the first feeble flight against the wind. But it was not until the beginning of the 20th century that any notable success was recorded in such attempts.

On Oct. 19, 1901, Alberto Santos-Dumont steered a cigar-shaped dirigible balloon, 108 feet long, 20 feet in diameter, and equipped with a propeller driven by a gasoline engine, around the Eiffel Tower in Paris, at the rate of 19 miles an hour. This feat proved to the world the future usefulness of the "airship." Germany, which organized for war as did no other country, at once saw the military possibilities of this invention, and from this time forward the supremacy in air navigation passed from France to Germany, chiefly

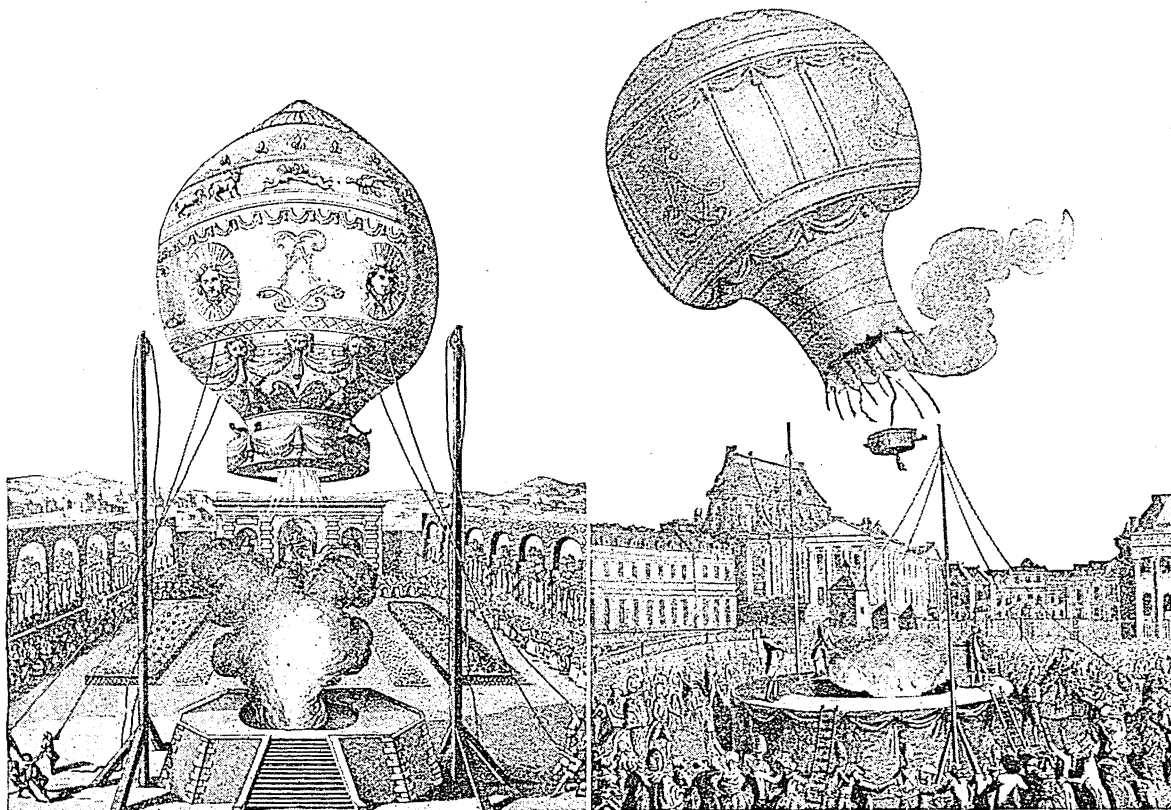
through the efforts of Count Ferdinand von Zeppelin.

It is said that during the American Civil War, Count Zeppelin, then a young military attaché to the German embassy in Washington, obtained the privilege of going up in one of the observation balloons behind the Union Lines. What he saw convinced him of the military value of balloons, and he returned to Germany to devote his life to this work. From 1897 on, his long experience was brought to bear on building dirigibles, but of a different type from those used by Santos-Dumont.

Count Zeppelin found that the long gas bag, which was necessary to give speed and steadiness, had a tendency to "buckle" in the middle when driven against the wind, so he constructed a rigid framework of aluminum, with compartments to hold many separate drum-shaped gas bags, tapering in size toward each end. The whole structure was covered with varnished silk. The framework also enabled him to attach some of the propellers to the balloon itself, instead of to the car, as had been done by other inventors. It also made it possible to bring the cars closer under the balloon, all of which gave increased power and lessened the "drag" of the air.

The first test of a "Zeppelin," as these huge rigid airships came to be called, was made in June 1900,

THE FIRST BALLOON ASCENSIONS IN THE HISTORY OF THE WORLD



These pictures, from old prints, illustrate two of the experiments of the Montgolfier brothers with their balloons. That on the left took place in the gardens of their father, a rich paper-maker in Annonay, near Lyons. The ascent on the right was made at Versailles in the presence of the king and queen and a large body of spectators. In a cage hung to the balloon were a sheep, a cock, and a duck.

and it attained for a short distance a speed of 18 miles an hour. In 1906 another Zeppelin traveled around Lake Constance, in Switzerland, turning curves and doing other "stunts" which proved the ease with which it could be steered. In 1908 another Zeppelin traveled 250 miles in 11 hours, but was wrecked in a storm. By this time Count Zeppelin's fortune was nearly exhausted, and the German government financed his projects.

Zeppelins in the World War

When the World War broke out in 1914, the Germans expected to spread terror in France and England with Zeppelin bombing raids. But the Zeppelins proved ineffective in the raids they made. They were easy targets when they flew low enough to aim their bombs. And for scouting they were inferior to the speedier airplanes. Furthermore, airplanes could fly around them and set them afire with incendiary bullets.

"Blimps" Against Submarines

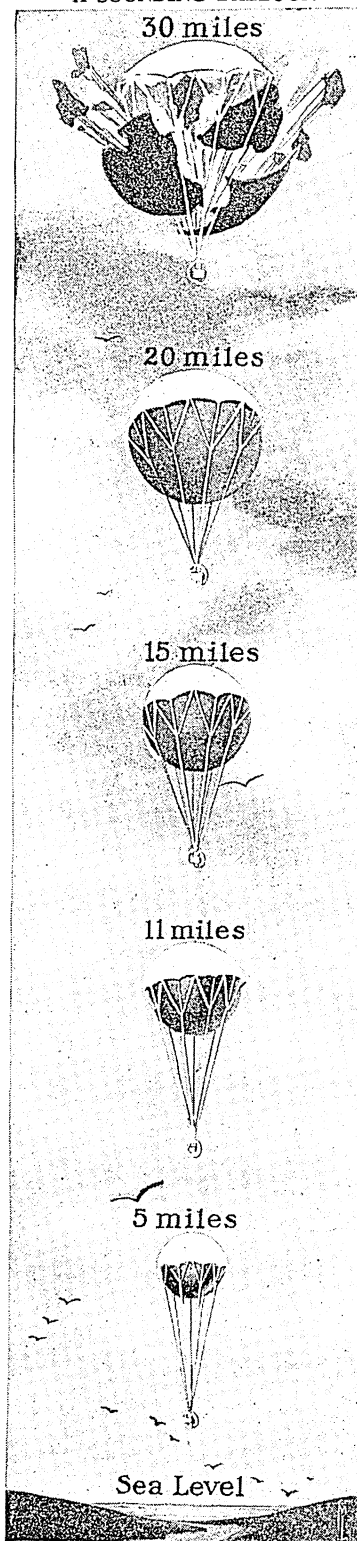
The Allied nations were more successful with dirigibles, since they followed a policy of using them for defense only and confined themselves to a small non-rigid type called a "blimp." This is simply a pointed gas bag held in a network which supports a light frame for controls and engines and a car for the crew. Blimps made about 35 miles an hour in calm air.

Because observers can see down into water when high above it, blimps rendered valuable service in patrolling the North Sea and the English Channel for submarines. When a U-boat was sighted, it was destroyed with depth bombs, dropped either from the blimp or from a destroyer which was called by radio to the spot.

"Sausages" or Kite Balloons

While both good and poor results were being achieved with wartime dirigibles, every major nation obtained valuable service from the modern type of captive balloon, commonly called a "sausage," but known officially as a kite balloon. Behind every battle line the sausages

A SOUNDING BALLOON



This shows how small India-rubber sounding balloons carry recording instruments to heights beyond the reach of man-carrying gas bags. As the balloon rises, the pressure of the atmosphere on the outside diminishes, allowing the gas inside to expand. The balloon keeps on swelling until finally the rubber bursts. Then the parachute brings the instruments safely back to earth.

bobbed in the wind, with observers who checked the accuracy of artillery fire and reported enemy activities by telephone.

The sausage shape of these balloons kept them from spinning around in a wind, as spherical captive balloons usually did. The gas bag was rigged to fly from a cable in a slanting position. The lower end had horizontal and vertical fins arranged like the tail structures on an airplane. These fins were inflated with gas, and also had bag-like structures which were open to the wind at the forward end. As the wind blew into these structures, it dragged the lower end back and thereby kept the upper end pointing into the wind. Sausages could rise to 1,500 feet on calm days.

Postwar Construction

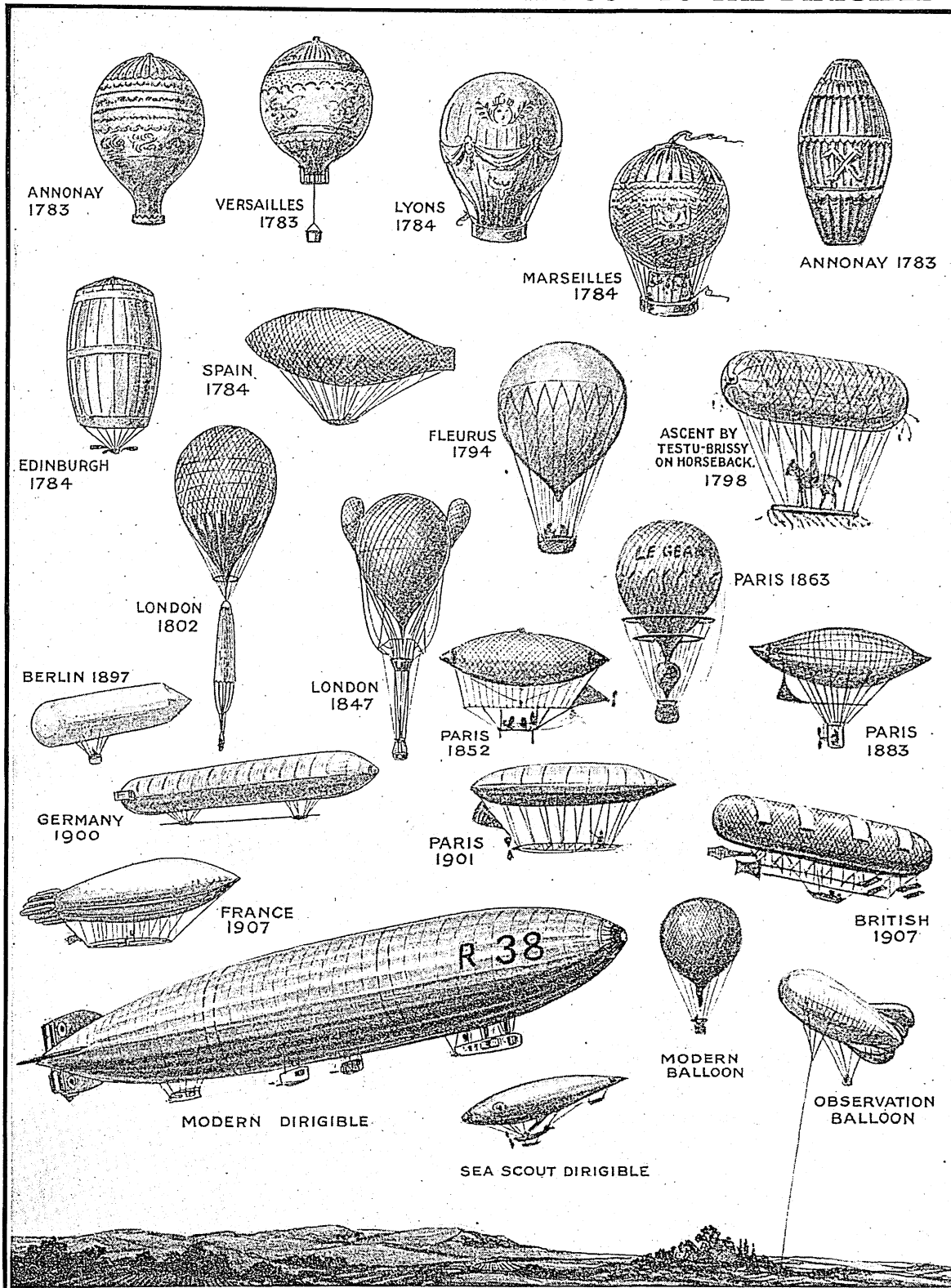
After the war, Great Britain, Italy, and the United States started building great dirigibles, and also took Germany's Zeppelins. Since Germany did not have enough to go around, it was compelled to build one for the United States.

The United States sought to profit further from the experience of other nations by ordering an airship, the *R-38*, from Great Britain, and a semi-rigid craft, the *Roma*, from Italy. In addition the government ordered one dirigible built in America at this period—the *Shenandoah*, which was put into service in 1923.

In the main, these postwar ships followed the Zeppelin design. The gas bag was made rigid with circular girders and ribs which ran from end to end; cross-braces were used wherever needed. The lifting gas was kept in separate cells to minimize leakage, and catwalks, or narrow passages, inside the gas bag gave access to all parts of the ship. In hydrogen-filled ships the engines were carried in gondolas, or nacelles, outside the main framework to reduce danger from fire; but since American craft used helium, a non-inflammable gas, some of them carried the engines inside the framework, to reduce air resistance.

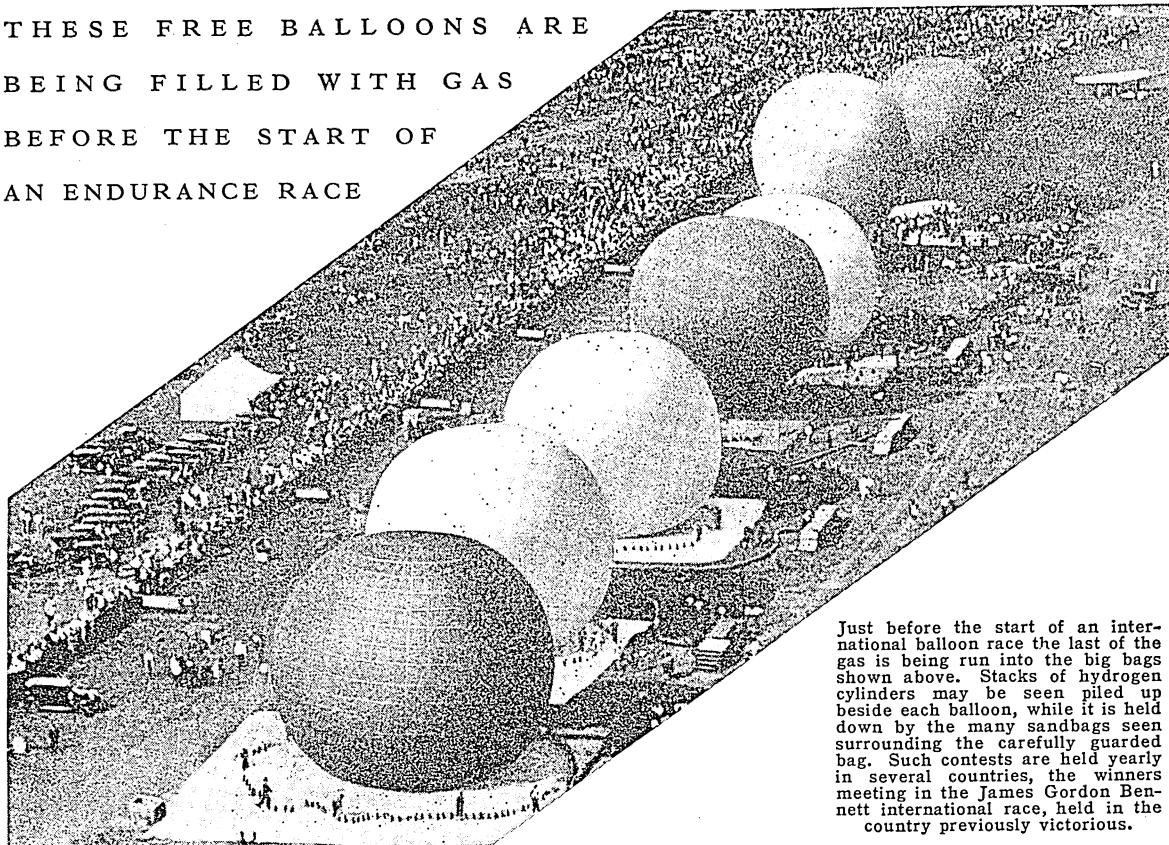
In all balloons and airships the lifting

FROM THE MONTGOLFIER FIRE-BALLOON TO THE DIRIGIBLE



Here is the family tree, so to speak, of the modern balloons, beginning with the picturesque devices of the Montgolfier brothers in 1783 and 1784 and ending with the dirigibles and observation balloons used in the World War. Balloons used for scientific purposes have not changed much in shape, and it is interesting to note how the latest of the dirigibles resembles the aircraft produced in Spain in 1784 and the one in which Testu-Brissay made his daring ascent on horseback.

THESE FREE BALLOONS ARE
BEING FILLED WITH GAS
BEFORE THE START OF
AN ENDURANCE RACE



Just before the start of an international balloon race the last of the gas is being run into the big bags shown above. Stacks of hydrogen cylinders may be seen piled up beside each balloon, while it is held down by the many sandbags seen surrounding the carefully guarded bag. Such contests are held yearly in several countries, the winners meeting in the James Gordon Bennett international race, held in the country previously victorious.

power, or *buoyancy*, comes from the difference in weight between the lifting gas and the equal volume of air which it displaces. Hydrogen gives a lift of about $1\frac{1}{8}$ ounces for every cubic foot; helium is about 92 per cent as effective. The *gross lift* so obtained supports both the airship and its load. As motor fuel is burned and the load becomes lighter, hydrogen is valved, or released into the air, to prevent too much rise. But helium is too expensive to be valved; so in helium airships, water is condensed from the burned fuel and kept to maintain weight. Descent is managed by means of the controls.

To increase lifting power, the postwar designers made larger and larger gas bags, keeping weight down by using duralumin and other light alloys. Other improvements were the use of a fabric covering painted with aluminum to reflect the sun's rays and prevent undue heating of the lifting gas, and the use of a synthetic material in the gas cells to replace the costly goldbeater's skin used in the early Zeppelins. Diesel engines were developed to burn non-explosive Blau gas. Speed was increased from the wartime 60 miles an hour to about 70 miles an hour in calm air.

A Grim Record of Disasters

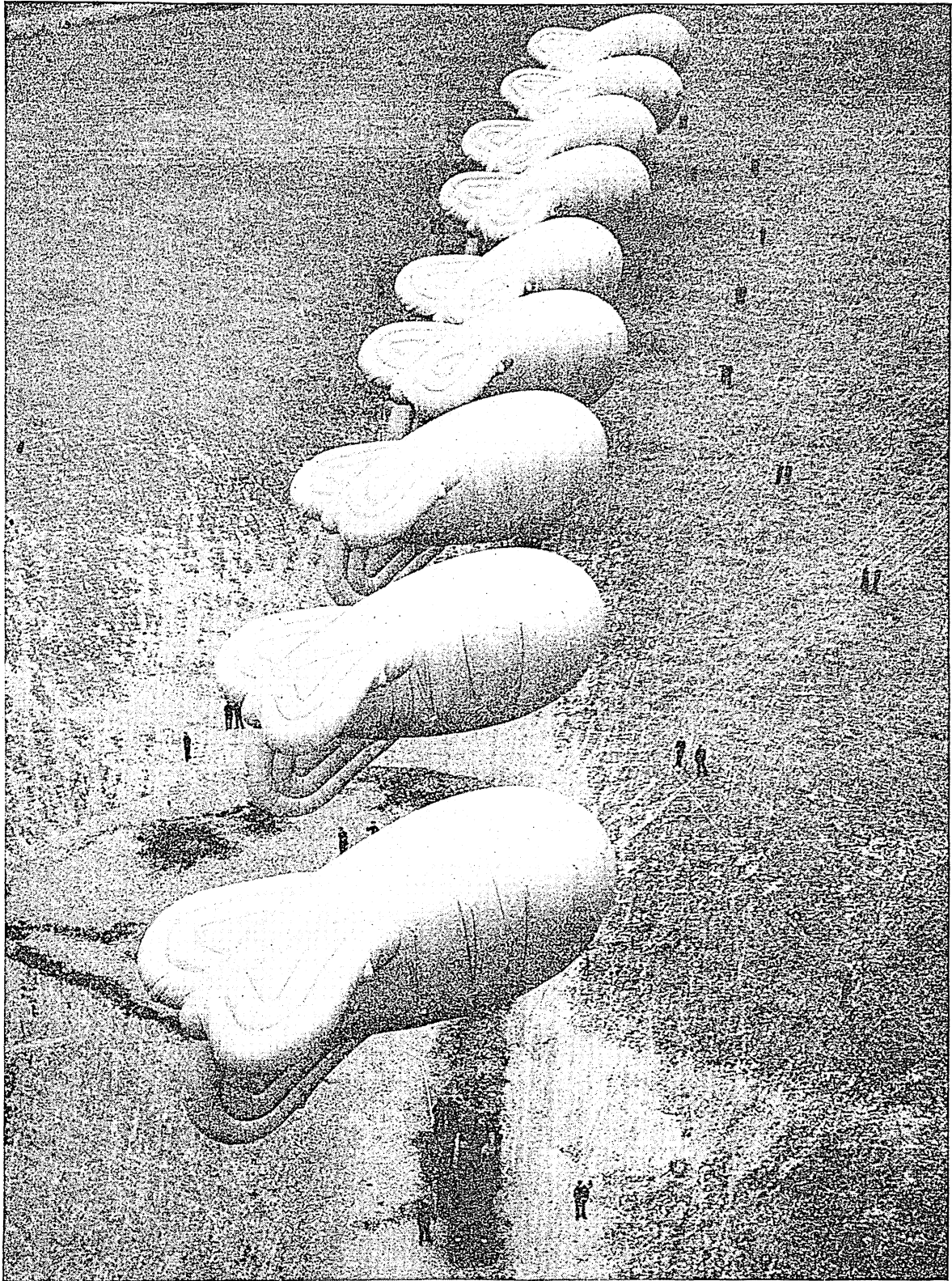
Postwar experience started well, when the British *R-34* made the first airship crossing of the Atlantic in 1919. It came from near Edinburgh, Scotland, to Mineola, N. Y., in 108 hours, and returned, helped

along by prevailing westerly winds, in 75 hours 3 minutes. In 1921, however, disasters commenced. The *R-34* was wrecked at its moorings in January; and on August 24 the *R-38*, the British ship built for the United States, collapsed and burned over Hull, England, with a loss of 42 lives. On Feb. 21, 1922, the Italian-built *Roma*, temporarily filled with hydrogen, exploded over Hampton Roads, Va., and killed 34 men. On Dec. 21, 1923, France's Zeppelin, renamed the *Dixmude*, was lost in the Mediterranean with all its 52 men.

The year 1924 brought one bright note, when America's Zeppelin, the *ZR-3*, crossed from Friedrichshafen, Germany, to Lakehurst, N. J., in 81 hours 17 minutes. It was named the *Los Angeles*, and gave good service until it was retired in 1932. But on Sept. 3, 1925, the *Shenandoah* was torn in two by a violent shift of winds near Caldwell, Ohio, and 14 men were killed.

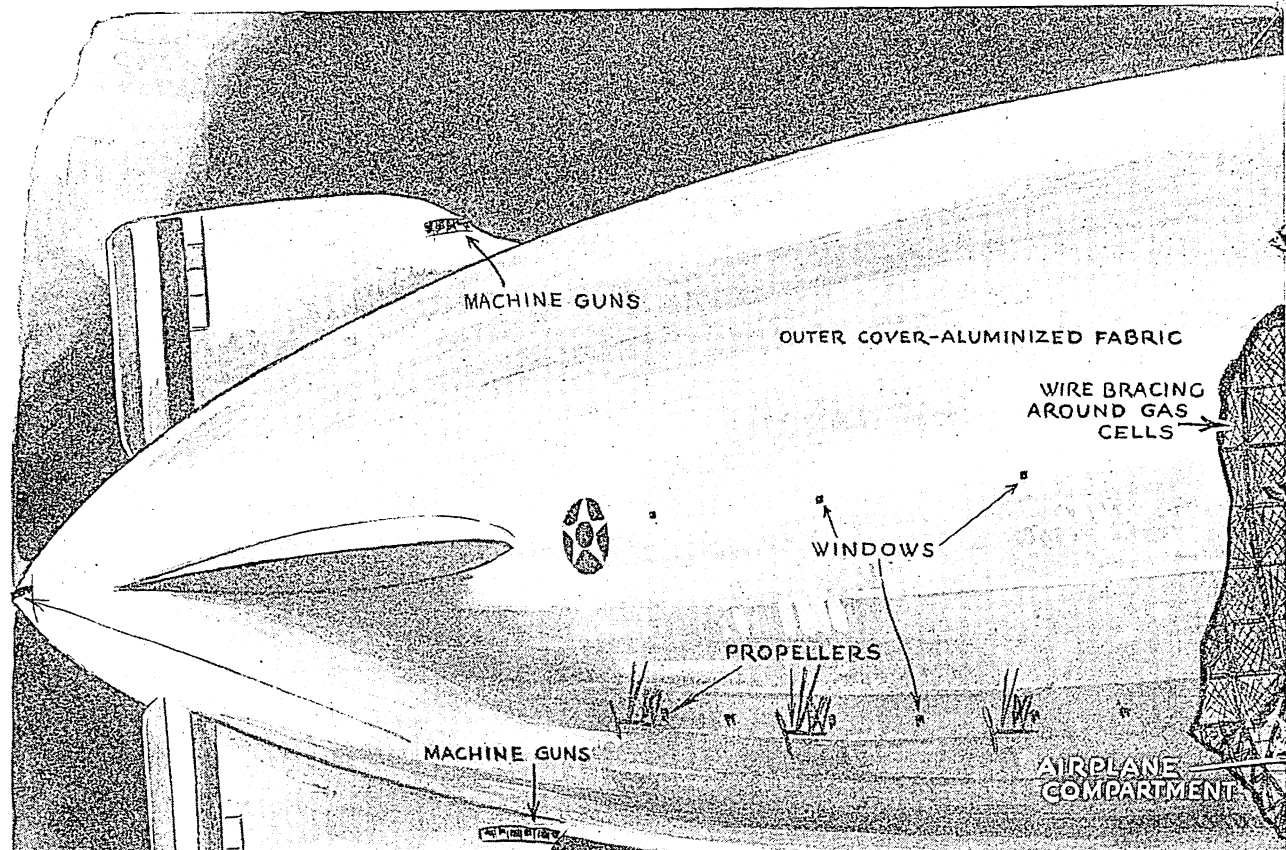
Italy gave up dirigibles when the *Italia* crashed on May 25, 1928, while flying to the North Pole, and killed six men. Great Britain held on until the *R-101* exploded over France on Oct. 4, 1930, and killed 46 men. The United States built two more ships after the *Shenandoah* disaster—the *Akron*, which was destroyed by a storm off the New Jersey coast on April 4, 1933, killing 73 of its 76 men; and the *Macon*, which fell into the ocean off the California coast on Feb. 12, 1935, killing two.

A BALLOON BARRAGE AGAINST AIRPLANES

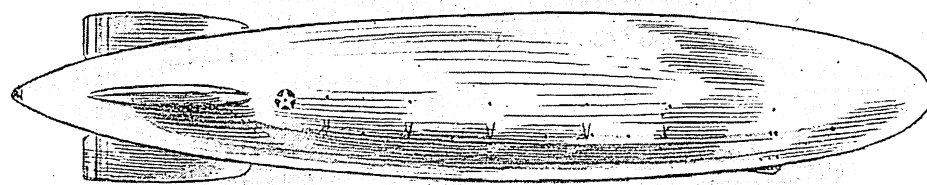


The kite type of captive balloon, with fins to hold it headed into the wind, found a new use when a second World War began in 1939. A row of balloons such as these carried aloft a web of wires to entangle airplanes trying to cross the protected line. This device was especially effective against airplanes diving unexpectedly from screening clouds or flying at night.

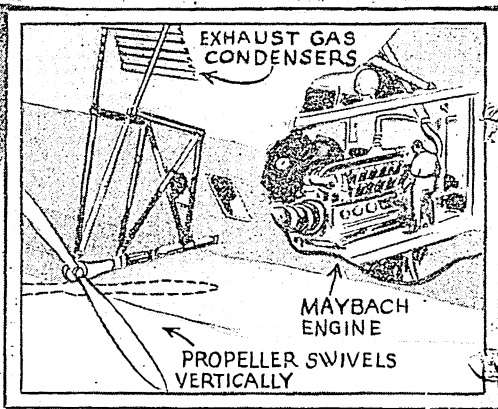
BUILDING THE HUGE ZRS-4 AND ZRS-5



LOS ANGELES : NOMINAL GAS VOLUME-2,470,000 CU.-FT.
LENGTH-658.3 FEET; HEIGHT-104.4 FEET



ZRS-4-5 : GAS VOLUME-6,500,000 CU.-FT.
LENGTH-785 FEET; HEIGHT-146.5 FEET

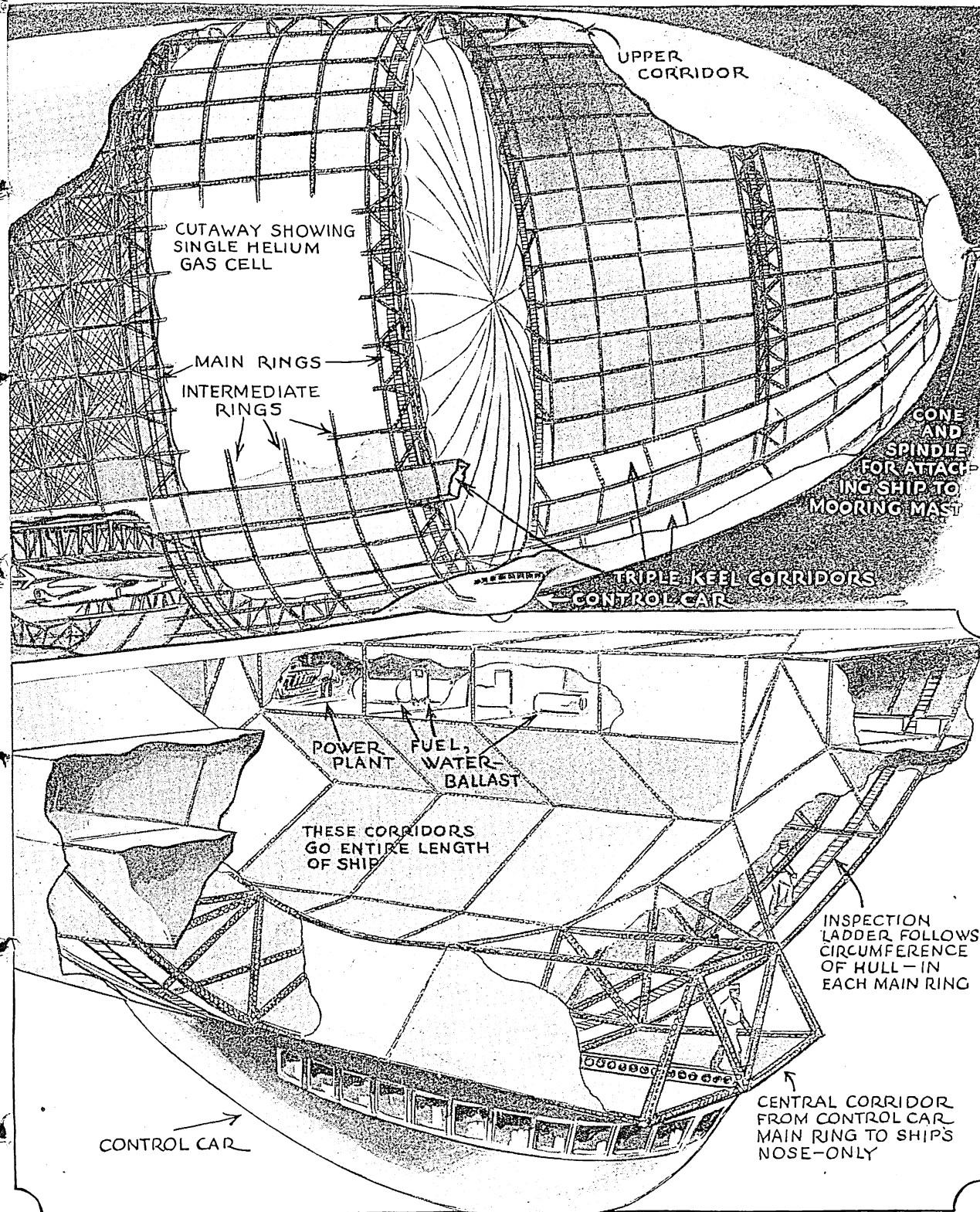


Above we see one of the eight engines, and its connections with the propeller. The lifting gas used, helium, does not burn; so the engine could be placed inside the hull. This reduced air resistance. A driving shaft ran sideways to the propeller, and the propeller was on a swivel, so that it could operate vertically or horizontally. Since the engine was reversible, the propeller could be made to drive the airship forward, backward, up, or down.

Among the largest airships ever built were the ZRS-4 and ZRS-5 of the United States Navy. They were built between 1930 and 1933 in a specially designed hangar at Akron, Ohio. The above sketch, showing construction and dimensions of the remarkable

craft, is based on material supplied by Dr. Karl Arnstein, designer of these airships. Both ships were exactly alike, with the novel feature of three corridors running the entire length of the ship, and with one short corridor running from the control car

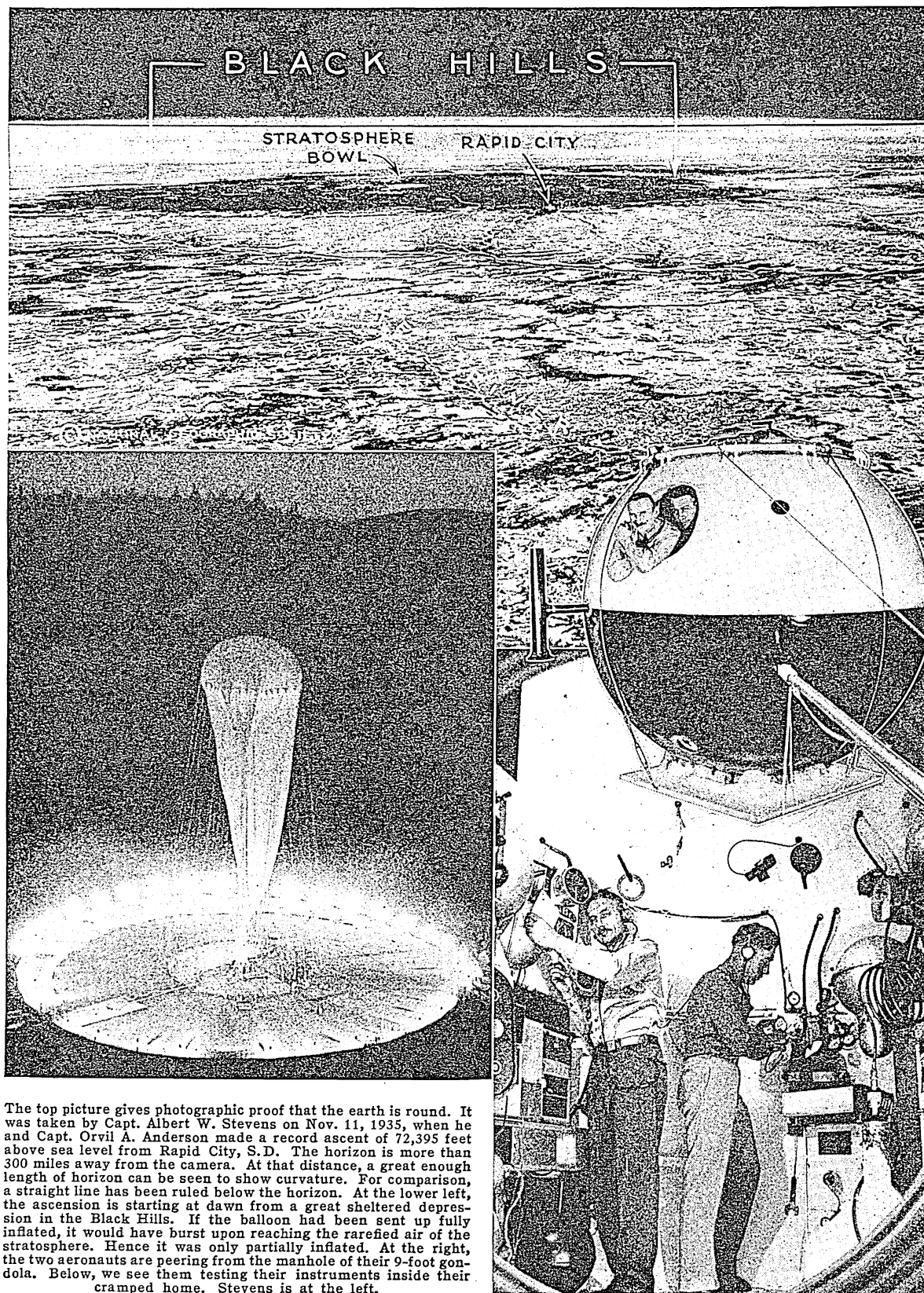
AIR MONSTERS OF UNITED STATES NAVY



to the ship's nose. Each ship was built to carry five small airplanes, and devices were installed to launch these planes and pick them up again in the air. The planes were expected to be useful not only for defense but for refueling the ship in flight. Thus, while the

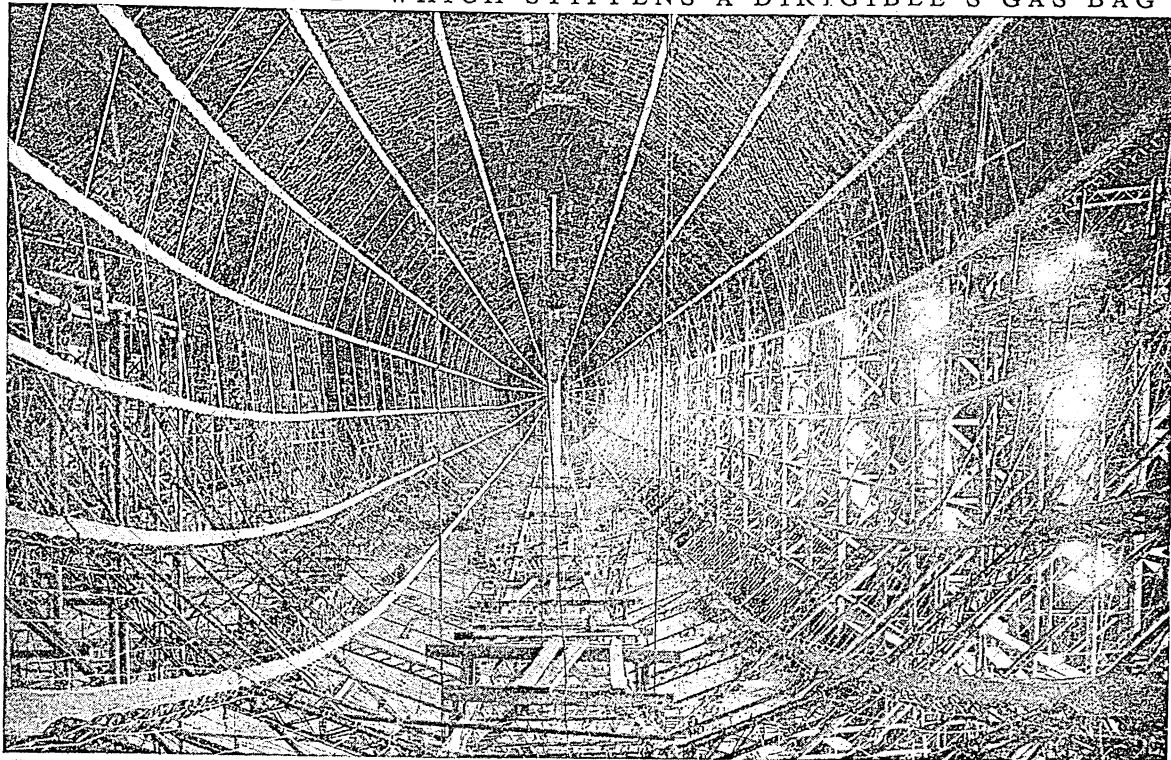
cruising range of these ships was about 10,000 miles, they could continue beyond that distance. The ZRS-4, named the *Akron*, was destroyed in a storm at sea in 1933. The ZRS-5, named the *Macon*, was similarly destroyed in 1935.

STRATOSPHERE FLIGHT SHOWS CURVE OF EARTH



The top picture gives photographic proof that the earth is round. It was taken by Capt. Albert W. Stevens on Nov. 11, 1935, when he and Capt. Orvil A. Anderson made a record ascent of 72,395 feet above sea level from Rapid City, S.D. The horizon is more than 300 miles away from the camera. At that distance, a great enough length of horizon can be seen to show curvature. For comparison, a straight line has been ruled below the horizon. At the lower left, the ascension is starting at dawn from a great sheltered depression in the Black Hills. If the balloon had been sent up fully inflated, it would have burst upon reaching the rarefied air of the stratosphere. Hence it was only partially inflated. At the right, the two aeronauts are peering from the manhole of their 9-foot gondola. Below, we see them testing their instruments inside their cramped home. Stevens is at the left.

THE METAL "WEB" WHICH STIFFENS A DIRIGIBLE'S GAS BAG



Here we are looking from one end, along the inside of the gas-bag frame of the British *R-34*, before the covering was applied. Long ribs extend from end to end. Around these ribs is a set of circular girders; they can be distinguished from supporting scaffolding by their lattice-like or truss construction. This framework can withstand some twisting, and it can bend somewhat in the middle without breaking. The finer rods and latticework between the ribs will support the outside covering.

For some time after the war the Germans did little in dirigible construction, because of treaty restrictions and lack of money. Finally, however, Dr. Hugo Eckener, postwar head of the Zeppelin works, built the *Graf Zeppelin*, and in 1928 flew it to the United States and back. In August of the following year the *Graf* flew around the world from Lakehurst, N. J., with stops at Friedrichshafen, Tokyo, and Los Angeles. Its actual flying time was 11 days 23 hours 14 minutes. In 1932 the ship entered regular service between Germany and Brazil, making the trip in about 70 hours.

On May 9, 1936, an even larger Zeppelin, the *Hindenburg*, reached Lakehurst in 61 hours 38 minutes from Friedrichshafen. This giant airship was 803.82 feet long, and 135.17 feet in its largest diameter; it floated a total weight of about 235 tons with about 7,000,000 cubic feet of hydrogen. The empty ship weighed about 125 tons, and fuel for a transatlantic flight about 75 tons. This left a carrying capacity of 35 tons for a crew of about 60, for the 50 passengers the ship was designed to accommodate, for ballast, and for about 15 tons of supplies, baggage, mail, and cargo.

The *Hindenburg* made 10 round trips in 1936, with average time of 64 hours 35 minutes westbound, and 51 hours 53 minutes eastbound. But just as it completed its first 1937 crossing at Lakehurst on May 6,

it caught fire and burned within half a minute. Of the 97 persons aboard, 35 were killed, as was one member of the ground crew.

Renewed War Uses for Balloons

These disasters had effectively discouraged use of dirigibles by the time war broke out in Europe in 1939. Kite balloons found extensive use, however, in forming *balloon barrages* around important localities such as Berlin and London. The balloons are tethered to winches which are carried on motor cars, and support a network of cables and wires. This provides a barrier against dive bombing, and high-level bombers must fly above the barrage to avoid entanglement. The United States Army has developed balloons which can carry a network as high as 15,000 feet.

The war also renewed the United States Navy's interest in nonrigid airships, or "blimps." Although these found little use in Europe, because they are vulnerable to airplane attack, they were considered valuable for American sea patrols in areas which hostile aircraft cannot reach. This service releases many surface vessels for other duties.

A list of terms commonly used in aeronautics will be found with the entry Aviation in the Fact-Index. **BALLOT.** The word "ballot" means "little ball," and our use of the term comes from the early practise of voting by colored balls. A white ball meant a favorable vote, and a black ball an adverse vote; from

this comes the expression "to blackball" a person, meaning to vote against admitting him to a club or similar organization.

Some form of balloting has been in use for centuries, but the use of "voting papers," or the ballot as we know it today, is of recent origin. As early as 1634 the freemen of Massachusetts Bay Colony demanded the written ballot instead of the usual "raising of the hands" in choosing a governor, in order that they might drop the aristocratic and unpopular Governor Winthrop from office. This was only an isolated case, however, and although a few states adopted the ballot system of voting in their new constitutions after 1776, *viva voce* voting (by "living voice") remained the general method in use. According to this the voter came to the polling place and announced publicly the names of the candidates for whom he voted, as was the custom of Great Britain until the adoption of the ballot there in 1871. This method encouraged vote-buying and intimidation; for when a vote was bought "the goods were delivered" in the buyer's presence; a voter was often influenced to vote against his better judgment because of fear of the ill-will of his landlord or employer if he voted against the latter's candidate.

The states of the American Union gradually abandoned *viva voce* voting, although it continued in some of the Southern states until after the Civil War. Unofficial written ballots were at first substituted for the *viva voce* method, each voter preparing his own ballot. Then the candidates began to print their own ballots; and later the political party had its ballots printed, each party using ballots of a different color. But still the ballot was not really secret, and corruption continued.

The next change came in 1888 when the states began to adopt the secret official ballot known as the "Australian ballot," because it was first used in Australia. There are two forms of this ballot, and one or the other is now used in every public election in the country. They are the "party column" and the "office column" ballots. On the first, the names of all the candidates of each party for various offices are arranged in a vertical column under the party's name; usually there is a circle at the top, and the voter can vote "a straight ticket" by placing a cross mark in it. In the other form of the ballot, which is the one used in Australia, the names of the candidates of all parties for a given office are placed in alphabetical order, giving each candidate's party connection after his name.

The second type requires more intelligent voting, but it is impractical in elections where the number of candidates is very large. As the number of elective offices has increased, the ballot has grown to unmanageable size, sometimes containing more than 400 names. These "blanket ballots" have become so complicated that it is difficult to vote intelligently, and for this reason an agitation has been started for a "short ballot" reform. This movement advocates the reduc-

tion of the number of elective offices by making minor offices appointive. In this way the size of the ballot may be reduced and simplified, and the voter can choose more intelligently. At the same time he may keep control by the use of the recall. (*See Initiative, Referendum and Recall.*)

Since about 1892 various types of machines have been in use for casting and counting votes. These voting machines are operated on the same principle as calculating and tabulating machines. (*See Calculating Machines.*)

BALTIC SEA. The great arm of the North Sea which lies between Sweden, Denmark, Germany, Finland, and the Baltic borders of Soviet Russia is the Mediterranean of northern Europe, and has for centuries been the chief highway by which the trade of that region has been carried on. It is chiefly by way of the Baltic that Russia has its outlet to the Atlantic. Russia's "window to the west" was obtained by Peter the Great, who early in the 18th century built his new capital, St. Petersburg—now called Leningrad—on the Gulf of Finland.

The "window" is closed three or four months of the year by ice. This is due not only to the fact that the Baltic region has a cold winter, but also to the fact that its waters contain only about a quarter as much salt as the ocean, and so freeze more readily. A fifth of the surface of Europe drains into it, through more than 250 rivers, among them the mighty Oder, Vistula, Neva, and Niemen. This enormous flow of river water, added to the fact that there is little chance for the water from the ocean to enter the Baltic through the narrow passages connecting it with the North Sea, explains why the waters of the Baltic are almost fresh. The narrow straits of the Sound, Great Belt, and Little Belt, and the Kattegat and Skagerrak furnished the only outlet to the Baltic until 1895, when the German government completed the Kiel Canal across the base of the Danish Peninsula.

Even when the Baltic is open to navigation, it is dangerous to seamen because of its extreme shallowness on the German coast, the ruggedness of the Swedish coast, and the frequent violent storms accompanied by sudden changes of wind. The greatest width is about 400 miles and the length is 960 miles. As in other inland seas, the tides are scarcely perceptible. The broken coast line—about 5,000 miles in length—furnishes some good harbors, the most important being Riga, Copenhagen, Kiel, Danzig, and Stockholm. The north part of the Baltic is called the Gulf of Bothnia; on the east are the gulfs of Riga and Finland.

The Baltic was the scene of a naval battle between the Danish and English fleets on April 2, 1801, known as the Battle of the Baltic, or the Battle of Copenhagen, in which the British seized or destroyed the Danish fleet to prevent its falling into the hands of Napoleon. At the beginning of the World War of 1914-18 there was some fighting between the Russian and German navies in the Baltic, but during the greater part of the war the German warships were imprisoned there by British naval strength. In 1939-40, when Europe was again engaged in war, Russia regained mastery of the eastern Baltic by resuming control over Estonia, Latvia, and Lithuania, and by exacting strategic concessions from Finland. (*See also Europe.*)

The THRIVING and HISTORIC City of BALTIMORE

BALTIMORE, Md. The westernmost of the eastern ports of the United States, the southernmost of northern ports, Baltimore is a city of contrasts and contradictions. Down on the Northwest Branch of the Patapsco River, in the noisy confusion of factories, wharves, and warehouses, it is easy to realize that this is the nation's seventh largest city, and one of its leading ports and industrial centers. A few blocks north, in the calm dignity of Mt. Vernon Place one becomes aware of Baltimore's historic past and its ties with the leisurely "old South."

Advantages of Location

Baltimore lies at the head of Chesapeake Bay, along the estuary of the Patapsco River. It is on the "fall line," where the rivers tumble down the rocky edge of the Piedmont Plateau to the flat Coastal Plain. Many cities grew up along this line, where they had the double advantage of water power and a position at the head of navigation. The highways and railroads connecting them passed through Baltimore because of its position midway between north and south. Thus the city became a commercial center of gravity to which industry was early attracted.

As settlements moved westward and farms replaced the wilderness, Baltimore's businessmen were quick to establish communication with the new producing area. They promoted federal construction of the Cumberland Road, westward from Cumberland, Md. And when New York threatened to drain the prized western trade through the Erie Canal, completed in 1825, they started to build the first railroad across the mountains, the Baltimore and Ohio, chartered in 1827.

Since the city is closer to the Middle West than any other eastern port, it has a valuable advantage in freight rates. On the other hand, it is far from the sea—170 miles. To offset this disadvantage, the Chesapeake and Delaware Canal was completed in 1829 across the upper part of the peninsula separating the two bays. The Federal government purchased the canal in 1919, and later made it a sea-level waterway accommodating all but the largest liners and battleships. It shortens the sailing time to Europe and to the northern ports of the United States by a day.

The Municipal Tidewater Airport and several others provide modern facilities for both land and sea planes.

Port of Baltimore

The best view of the harbor is from Federal Hill, now a city park. In the days when the famous Baltimore clipper ships were sailing the seven seas, signals from this hill informed merchants when their

ships were entering the river. Today the harbor is crowded with freighters bringing in shiploads of iron, manganese, and copper ores; of sugar and molasses; of petroleum, rubber, and coffee. Most of the imports come from Latin American countries. Outgoing vessels carry copper products, coal, iron and steel products, grain, flour, chemicals, and cotton.

The Industrial City

Baltimore was a manufacturing center from the first. For many years the world's greatest copper smelting city, it is still one of the leaders. A copper rolling mill was in operation as early as 1800, and about 1845 a colony of Welsh workmen was brought in to smelt copper ores. "Baltimore copper" soon became famous for its uniform quality.

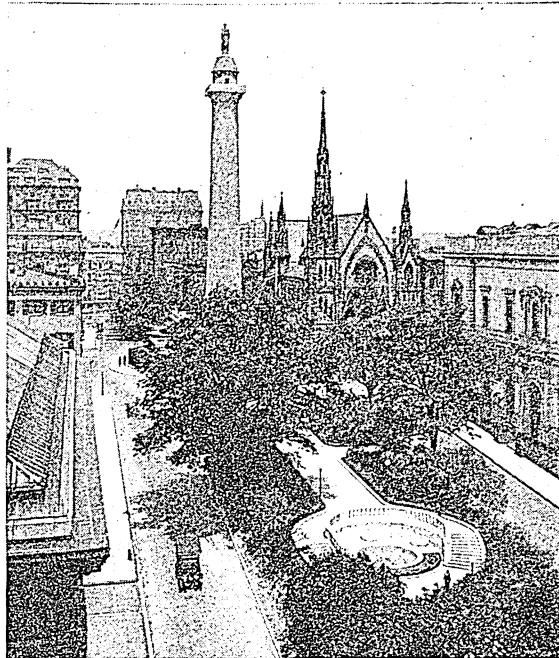
Baltimore is also one of the chief canning centers of the country. The far-reaching arms of the Chesapeake and Delaware bays afford cheap transportation by boat for fruits, vegetables, and fish from widely scattered localities. Tin cans are manufactured to supply the demands of the canning industry.

The great Bethlehem steel mills at Sparrows Point are among the largest in the world. Shipyards that built the swift clipper ships now build steel vessels. The Glenn L. Martin Company produces great clipper planes for transoceanic air service and giant bombers. Chemicals, fertilizers, industrial alcohol, petroleum products, clothing, straw hats, refined sugar, coffee, and spices are other items on the long list of products in which Baltimore is a leader.

The "Monumental City"

The settlement that occupied 60 acres in 1729 has grown to cover 92 square miles. Marshes have been drained, hills leveled, and valleys filled in. Many wooded streams and hills still remain, however, to add their natural beauty to the parks and suburbs.

THE FIRST WASHINGTON MONUMENT



In Mt. Vernon Place is America's first memorial to Washington. Its cornerstone was laid in 1815 and the statue, carved by Henrico Caucici, an Italian sculptor, was placed on top in 1829. The monument was designed by Robert Mills and Rembrandt Peale. It is 204 feet high, including the 16-foot statue.

The old part of the city near the river has its original narrow, crooked streets; here and there are old houses with beautiful doorways and iron work. Long lines of identical "row houses" with gleaming white steps are characteristic. Westminster Churchyard, where Edgar Allan Poe is buried, is in this part of the city. Here too is the Cathedral of the Assumption, the first cathedral in the United States.

Pope Pius XI in 1936 gave it the rank of minor basilica, a title bestowed for its historic associations. In its crypt is buried James Cardinal Gibbons, statesman and church leader, and one of Baltimore's most famous citizens (see Gibbons, James, Cardinal).

In the heart of the business district, quiet Mt. Vernon Place on Monument Street and Washington Place on Charles Street form a cross radiating from the base of the Washington Monument. The area is popularly known only as Mt. Vernon Place. Century-old residences overlook its gardens planted with cherry trees and azaleas, its fountains, and its statues. Washington Monument, begun in 1815, was the country's first memorial erected in honor of George Washington. Many other fine memorials in different parts of the city have given Baltimore the name "Monumental City." Among the most famous are the first monument in the New World to Columbus, dedicated in 1792; and the Battle Monument, commemorating the bravery of the Baltimore militia in repulsing British attacks during the War of 1812.

The Battle Monument stands in the Civic Center, southeast of Mt. Vernon Place. This group of public buildings includes the white marble courthouse, containing mural decorations by the artists Blashfield, Turner, and La Farge; the City Hall, Municipal and Federal buildings; and the War Memorial on Memorial Plaza. The 234-foot shot tower, built in 1828 for the manufacture of shot, is another familiar landmark.

Great Educational Institutions

North of Mt. Vernon Place is Johns Hopkins University. A power among world educational institutions, it was endowed by Johns Hopkins, wealthy Quaker banker and merchant. It opened in 1876 with an eminent staff that included Daniel Coit Gilman as first president; Ira Remsen, professor of chemistry; and Henry A. Rowland, professor of physics. The poet Sidney Lanier was a lecturer in English literature from 1879 until his death in 1881. The Medical School has made many contributions to medicine and surgery under the leadership of such men as Sir William Osler

and William Henry Welch. The school with its many hospitals and clinics is on and near Monument Avenue, east of Mt. Vernon Place.

Baltimore is also the home of Goucher College for women; Peabody Institute and Conservatory of Music; the University of Maryland's schools of medicine, pharmacy, and law; Baltimore College of Dental Surgery, the first dental school in the world; and Mary-

land Institute of Art. The Walters Art Gallery, Baltimore Museum of Art, and Maryland Historical Society have notable collections.

Youngest of the Atlantic Cities

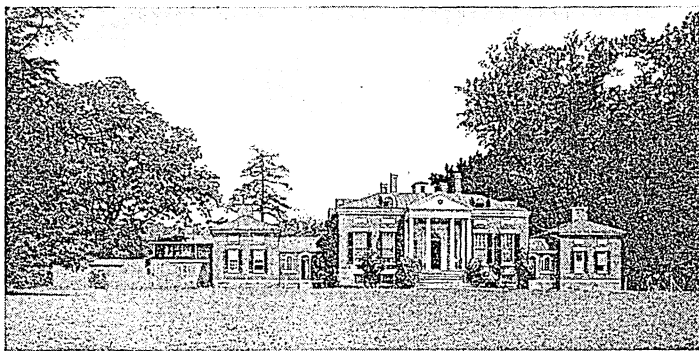
Baltimore was created to meet the need for a port to serve the growing settlements along the upper reaches of the Patapsco River and Chesapeake

Bay. In 1729 a town was laid out on the east side of Jones Falls. It united in 1745 with an earlier settlement on the west side of the falls and took the name of the Lords Baltimore who had founded the colony of Maryland a hundred years earlier.

During the Revolutionary War the blockade of the rival port of Annapolis helped to divert trade to Baltimore. The city equipped many privateers to prey on British shipping. For several weeks (Dec. 20, 1776—Mar. 4, 1777) the Second Continental Congress met here. In the War of 1812 Baltimore privateers were again active, claiming 476 British ships sunk or captured, with a loss of only two clippers. England called the city a "nest of pirates" and bombarded it unsuccessfully on the night of Sept. 13-14, 1814. The sight of the American flag still flying over Fort McHenry the following morning inspired Francis Scott Key, who was held on a British ship in the harbor, to write 'The Star Spangled Banner' (see National Songs). The house where this flag was made by Mrs. Mary Pickersgill is preserved as a memorial. Fort McHenry is now a national park. The manuscript of the song is in the Walters Art Gallery.

The first blood of the Civil War was shed when a Baltimore mob attacked the Sixth Massachusetts Regiment as it passed through the city on its way to Washington, Apr. 19, 1861. Although Maryland did not secede, its loyalties were divided, and Baltimore was placed under martial law by Union troops for the duration of the war. Abraham Lincoln was renominated for the presidency at the Republican Convention held here in 1864. The business section was burned Feb. 7 and 8, 1904. More than a thousand buildings were destroyed with a property loss of about \$125,000,000. Population (1940 census), 859,100.

THE CARROLL HOME ON JOHNS HOPKINS CAMPUS



This mansion (also known as Homewood) was built in 1809 by Charles Carroll, a signer of the Declaration of Independence, as a wedding gift to his son. It is a beautiful and perfectly preserved example of Georgian architecture.

BALZAC (*bäl-zäc'*), HONORE DE (1799-1850). This great French novelist was a heavy, bulky, dreamy man, who seemed to radiate strength and to turn off novel after novel, most of them masterpieces, with one



HONORE DE BALZAC
Giant of French Novelists

shake of his massive inspired head. There have been other novelists who threw a stronger beam of light on certain corners of life, but few who so widely and brilliantly illuminated the whole of it. Balzac was the first French writer who sought to place on his pages our life entire—its good, bad, and mediocre points; its weak, strong, happy, sad, struggling, noble, and base sides—in one welter together. His stories are as lifelike as though someone had pointed a motion picture camera at the scenes and people he writes of; only Balzac did more. The lens of his genius and his great understanding soul could look deeper than the surface of a picture. It could see through into the minds and hearts of people, and show how one event dragged another with it, and how one man's life was fatally linked with another. The motion picture shows us a street full of people mysteriously rushing about. Balzac can show us where they are going, what will happen because they go there, and what they are thinking about while they go that makes their eyes so bright or their lips so pale. He shows them as a part of the entire great world, not as little desperate interesting fragments. That is why he is said to have "a sense of the whole," and why his books are so clear, even in their wide detail. His famous series of novels called 'The Human Comedy' was intended to be a complete picture of modern life.

But when we learn that he wrote 85 of these wonderful lavish novels in 20 years, we inquire what was the hidden dynamo which drove this indolent, sentimental heavy man to such a flood of energy, when he really liked to live easily, collect fine old furniture, keep a good cook, and chat with a few old friends. Let us examine his history to find out.

He was born at Tours, educated there and at Paris, where he was an insatiable reader rather than a brilliant student. He studied law, failed in its practice, and until 1829 wrote worthless "pot-boilers" for the money they brought. Then his 'Chouans' was published, and his real work began. In 1834 he met the lovely Countess Hanska, a Polish beauty whom he worshiped at a distance and through a long correspondence, until at last they were married in 1848. But their great difference in social position and wealth forced him to compel the favors of fortune. He wrote like

a slave, whipped his nerves with black coffee, stuck hours at his desk, engaged in wild financial speculations, to grow rich and marry his countess. He was always, like Sir Walter Scott, fighting against debt. When his fame was so brilliant that he was the social equal of the countess, and when his finances permitted, he attained his dream of marriage with her—only to die a few months later, wrecked by his frenzy of work in the years before.

Balzac's chief works are: 'Les Chouans' (1829); 'La Peau de chagrin' (The Wild Ass' Skin), 1829; 'Le Curé de Tours' (1832); 'Eugénie Grandet' (1833); 'Le Lis dans la vallée' (The Lily of the Valley), 1835; 'Le Père Goriot' (Old Goriot), 1835; 'César Birotteau' (1837); 'Ursule Mirouet' (1841); 'La Maison Nucingen' (The House of Nucingen), 1846; 'Le Cousin Pons' (Cousin Pons), 1846; 'La Cousine Bette' (Cousin Betty), 1847.

BAMBOO. The colossal treelike grass called bamboo has been well styled "one of the most wonderful and most beautiful productions of the tropics, and one of Nature's most valuable gifts to man." It is a gift with which Nature is generous; for nearly 500 species grow in Asia; in South, Central, and North America; and in Africa. Asiatic varieties have been imported by Europe and the United States, since the bamboo also flourishes in temperate zones. A single root may grow as

BAMBOO, THE KING OF GRASSES



Groves like this one in eastern China shoot to the skies at amazing speed. Bamboo grows sometimes at the rate of a foot a day.

many as 100 polished jointed stems rising 30, 50, or even 120 feet. Branches are numerous toward the top. Flowers and seeds are produced yearly by some kinds, while others bloom only once in 50 or 100 years. The bamboo stem is sometimes three feet around. Young sprouts grow fast, at times a foot and a half daily.

The canebrakes of the southern United States are a variety of this evergreen grass native to this country. To keep out pests, the government has since 1919 banned importation of living bamboos or seed, except by the Department of Agriculture.

Bamboo provides man with everything from a delicious meal to a house. Probably you have eaten bamboo sprouts in chop suey. The Orientals serve the sprouts like asparagus, or candy, or pickle them. Some bamboos have a grain, like barley, used as food in China and India. A Chinese proverb says that the bamboo seed is more plentiful when the rice crop fails.

The hollow bamboo stem is used for posts of houses. Split into strips it forms the planks for floors, roofs, and sides. Besides the familiar fishing-rod, it is also used for water-pipes, bridges, and cables, and the joints of the large stems are even used for pails and for cooking utensils. Strips are woven into mats, chairs, beds, cradles, cages, porch curtains, and other articles of furniture. Chop sticks, hairpins, phonograph needles, and the ribs of fans are made of bamboo, and from the interior portions, beaten into a pulp, is made a fine variety of paper. The outer skin of some species is so hard that native knives and swords have been made from it, with a sharp and durable cutting edge.

BANANA. The story of the banana industry is one of the wonderful romances of this modern age. Not very long ago this fruit was a luxury in temperate regions and a little-known luxury at that. The tall broad-leaved plant was cultivated by white settlers and natives in tropical lands only for their own use. The first bananas brought into the United States came about the middle of the 19th century, and for several years they were merely expensive novelties at some of the southern and eastern seaports.

The Romance of the Banana

Then Captain Baker, the owner of a Cape Cod schooner, getting ready to return home from a trip to Jamaica, looked around for a cargo. Because other freight was lacking he purchased a few bunches of green bananas. He made a quick voyage and docked in Boston with the bananas ripened and in fine condition. Hunting up his friend Andrew W. Preston, he said:

"Preston, I've got some fine tropical fruit for you."

"What kind of fruit?"

"Bananas."

"Bananas! I can't sell bananas. By the time they get here they're so decayed they're ready to throw away."

"Is that so? Look at this," and he pulled out of his pocket a fine golden-yellow specimen very much like the fruit we are so fond of today.

The fruit dealer took the whole lot. He realized the great commercial possibilities of the fruit if it could be transported without spoiling; and investigating the possibilities, he laid the foundation for the great banana industry. Later he became the president of the United Fruit Company, which imports more than half the bananas brought into the United States today, and which has done more than any other

organization to bring the banana within the reach of every consumer.

But the task was by no means a small one, for the obstacles with which he had to contend were as discouraging and varied as the tangled forests and swamps of the tropics could make them. Transportation of the fruit was only a small part of the problem, for banana plantations themselves had first to be started. Contrary to common belief, most varieties of the wild banana do not bear edible fruit, but only a long pod filled with large seeds surrounded by very little pulp.

Forests had to be cleared and swamps drained; railroads had to be built, bridges thrown across mighty streams, safe harbors made, and a fleet of specially constructed ships provided so that the fruit could be speedily transported. Today millions of acres of land are under cultivation, and bananas are raised on most of the islands of the West Indies and along all the Gulf and Caribbean coasts from Vera Cruz to the mouth of the Amazon. Central America is the greatest banana-producing area in the world. Cities with good schools and hospitals have been built where only a few years ago were disease-breeding jungles. Not only do the natives of these countries grow bananas in large quantities, but many persons from the United States and Canada have settled there and started plantations. The banana is also an important crop in the Canary Islands, throughout the Pacific islands, some parts of Africa, the Malay region, and the East Indies.

Why Bananas are Picked Green

Bananas are seldom allowed to ripen on the trees. The tree-ripened fruit matures so quickly that the skin breaks, and ants, bees, and other insects feed upon the pulp, spoiling it. So the bananas we buy in the store taste about the same as they do in the tropics, because they are cut green in either case.

There are, however, many delicate varieties that cannot be exported because of their tender skin. Among these is the little straw-colored "lady finger" banana of the Canary Islands, which when fully developed is only three or four inches long, and has a melting pulp and exquisite flavor. The *Mensaria* Rumph, the "best of all bananas" of the Malay Archipelago, has a soft pulp scented as if with rose water. Other specially prized varieties are the *Lacatan*, a very sweet greenish-yellow banana of the Philippines, and the *Champa* of India, which rivals the pear in lusciousness.

There are nearly 70 known species of banana. Some of these, known as plantains (*Musa paradisiaca*), are "cooking bananas" and are almost never eaten raw. The fruit of one kind of plantain grows to an enormous size, sometimes two feet in length and as thick as a man's arm. Plantains constitute one of the chief foods of the natives in the tropics, taking the place of our bread and potatoes, but they are seldom exported as they are not in demand where potatoes are available.

FROM PLANTATION TO STEAMER



In this banana grove in Costa Rica bunches of the green fruit are piled on the platform ready to be hauled over the narrow-gauge railroad to the point of shipment. Notice the height of the banana plants compared with the men on horseback.

Banana "figs" are sold in large quantities in tropical countries as sweetmeats. They are ripe bananas which have been preserved by sprinkling with sugar and drying in the sun. Banana flour, prepared by drying unripe bananas and grinding, is largely used in the tropics. The flower clusters of some species of the banana plant are considered a delicacy in India. They are generally cooked in curries.

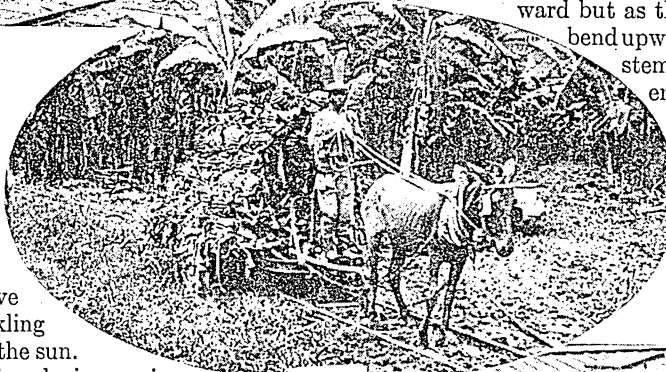
But That Isn't All the Banana Does

With all these food uses you would think that the banana plant had done enough for man. Its broad leaves, however, are often torn into strips and woven into mats and coarse cloth; and the fiber which they contain is in common use by the natives for cordage and to some extent for paper. Indeed, one of the most important fiber plants that we have, from which comes the manila fiber used so largely for twines, ropes, and wrapping papers, is a close cousin to the plants which produce these tropical fruits, its scientific name being *Musa textilis*.

A banana plantation is a magnificent sight, often extending over thousands of acres. The tree-like plants grow to a height of from 12 to 30 feet, and the great drooping leaves, from 8 to 12 feet long and 1 to 2 feet wide, meet in arches that shut out the light of the sun. The plants grow from rootstocks and are usually propagated by shoots of the parent stem. They

are planted in rows, very much like rows of corn, although they are set much farther apart to make room for the spreading leaves. The true stem is underground, but there is a stalk often a foot or more in diameter at the base, made up of the sheathing bases of the leaves, which protects the flowering stem as it pushes its way upward. Soon a long "bud" appears, made up of tightly overlapping purple scales, each of which protects a cluster of true flowers. The lower clusters wither and only the upper ones are fertilized and produce fruit. The bananas grow around the stem in ridges called "hands," the bunch having from 6 to 9 hands to a stem, and 14 to 20 "fingers" (bananas) to a hand. When the bananas are small they point outward but as they grow larger they bend upward and in toward the stem, and so grow with the ends turned up. The bunches we see hanging in our stores are thus *upside down*.

These two humble servants of the public keep going back and forth all day long on the narrow tracks hauling the fruit to the docks.



Here the bananas are being put into the hold of the vessel. The two men standing near the hatchway are holding up a particularly fine bunch for you to look at.

The banana plant grows and produces fruit in from 12 to 18 months. Each plant produces but a single bunch of bananas and after the harvest is cut down; but new shoots soon spring from the old rootstock.

Bananas are 75 per cent water, but are excellent food, because the starch they contain when green changes to sugar when they ripen, and there is more

of it than in most fruits, so that they are good heat producers. In addition, bananas have vitamins and alkaline salts, and so are a "protective" food.

Most of the bananas sold in the United States belong to the variety known as "Gros Michel," which roughly translated means "Big Mike" (*Musa sapientum*); it is the large smooth yellow product of Jamaica and Central America. The Canary Island banana (*Musa cavendishii*), better known as the dwarf Chinese banana, is quite extensively raised in some sections of Central and South America, where other types cannot be raised because of a soil disease to which the Chinese banana is immune. It is smaller than Gros Michel but finer in flavor. The red Jamaica banana or baraoa is grown in various parts of the world, including the American tropics, and while it is popular with the public it is difficult to ship because the individual bananas do not cling closely to the stem.

BANGKOK, SIAM. Until recent times Bangkok, the capital of Siam, was the Venice of Asia. Not only was its commerce carried by water, but a large proportion of its people lived in houseboats on the river Menam. Now, however, the city has been modernized. Wide thoroughfares, carried across the canals by bridges, are lined with brick buildings, lighted by electric lamps, and traversed by electric street-cars. The new city surrounded by high walls has been laid out around the royal palace and its parks, which form the center of local interest. The modern aspect of this new section contrasts strangely with the numerous Buddhist temples, whose gilded spires and decorated roofs of carved teak-wood are found in all directions.

Lying only 20 miles from the mouth of the Menam, Bangkok is the center of the foreign trade of Siam. The chief exports are rice and teak, and its imports are cotton and silk goods, foodstuffs, machinery, and oil. Most of its trade is in the hands of Chinese and European merchants. Population, about 885,000, of whom a large proportion are Chinese.

BANJO. The negro of the South made the banjo famous, for this most commonplace of musical instruments in his hands will crash out the liveliest of tunes, or sob like a human heart. The negro poet, Paul Dunbar, sings its praise:

. . . I jes' lets down
A banjo string or two
Into the deepest of my heart,
An' draws up chunes for you.
Slowly dey comes swingin' up,
Aquiv'rin' through an' through,
Till wid a rush of tinglin' notes
Dey reaches light—an' you!

The banjo has a round tambourine-like body formed of parchment stretched over a frame, and a long neck. The catgut strings, usually five in number, are plucked or struck with the fingers of the right hand while the fingers of the left hand lengthen or shorten them by pressure against the fretted neck. The negroes are believed to have brought this instrument with them from Africa.

BANKRUPTCY. In the days of the later Middle Ages, when the Italian cities were the money markets of the world, it was the custom to break the bench of any money-lender or banker whose debts became

greater than the amount of his property. As his bench was his place of business, the breaking of it forced him to discontinue his former pursuit, and also implied disgrace. From the words describing this custom (*banca* meaning "bank," and *ruptus* meaning "break") has come our modern word "bankrupt"; and from the custom itself comes the practice of all modern nations of forcing a man who cannot pay his debts—that is, who is a bankrupt—to discontinue his business. This is done by means of bankruptcy laws.

When the fathers of the United States drew up the Constitution, they put in it the provision that "Congress shall have the power to establish uniform laws on the subject of bankruptcies throughout the United States." At first this power was seldom exercised, for most business was local in character and the regulation of it could readily be left to the individual states. In 1800, 1841, and 1867 federal bankruptcy laws were passed, but each was of an emergency character and remained in operation only a few months or years. When business operations began to expand, and a man's creditors would often live in a dozen different states, it was necessary for Congress to provide a permanent federal law on this subject, and in 1898 and 1938 the present bankruptcy laws were passed.

According to these laws there is voluntary and involuntary bankruptcy. A debtor may become a voluntary bankrupt by filing a petition with the judge of the United States District Court, setting forth the fact that he is unable to pay his debts and that he is willing to surrender his property to his creditors. Any corporation (with certain exceptions) or any person (except wage earners and farmers) who owes \$1,000, or more, may be declared an involuntary bankrupt by the district court, if he in any way attempts to cheat his creditors, or if he admits in writing his inability to pay his debts. In this case the creditors must file the petition.

After a petition has been filed, either the judge of the court or a referee in bankruptcy to whom the judge may refer the case appoints a day on which the creditors may present their claims. If it is decided that the debts of the man are, as is claimed, greater than his property, he is declared bankrupt, and his property is handed over to a trustee. The trustee sells the property and divides the proceeds among the creditors in proportion to their claims. As soon as the settlement is finished, the debtor is discharged from bankruptcy and the remainder of his debts is canceled.

In this way both creditor and debtor are protected. The debtor cannot continue contracting debts and so lessen the amount which each of his creditors will receive; each creditor, also, is assured of receiving his fair share of the bankrupt's property. On the other hand, after the bankrupt is discharged from bankruptcy he is able to start business anew, without the burden of the old debts which he could never hope to pay. It is more profitable for the creditor than the old method of imprisoning the debtor for debt; and

it is also more just to the honest debtor, for in this day of complicated business enterprises, a man often may become a bankrupt through no fault of his own. The revised bankruptcy law of 1938 permits hard-pressed debtors who earn not more than \$3,600 annually in salary or wages to pay their debts in instalments,

but they may still choose voluntary bankruptcy instead. The early law of Rome gave a man's creditors the right to divide his body among them, or to sell him and his family into slavery. In England a bankrupt person cannot hold public office unless the court rules that the failure was not due to misconduct on his part.

The STORES that "Buy" and "Sell" MONEY

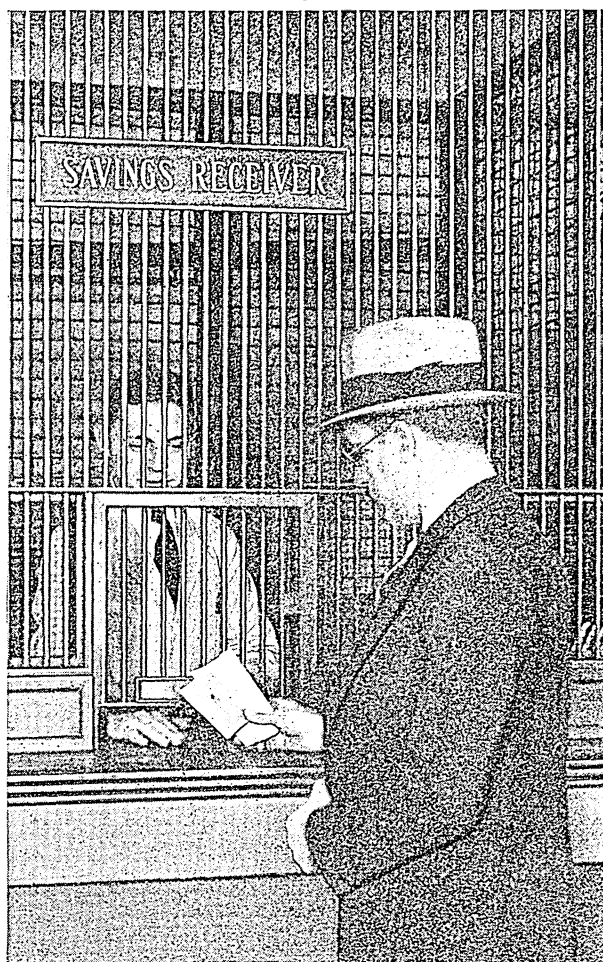
BANKS AND BANKING.

The modern bank is a complex institution—a financial department store. But banking in itself is not a mysterious or secret process. A bank has two main purposes. First, it accepts and cares for deposits of money from people who do not immediately need it. It pays this money out at the order of the depositor and in some cases pays interest for its use. Second, it makes loans to people who need them and who are willing to pay interest on them and can give good security.

Bank loans help business in many ways. A farmer, for example, may borrow money against warehouse receipts for wheat, to be repaid when the wheat is sold. Or he may borrow to buy land, giving the bank a mortgage on the land as security. The merchant or manufacturer may borrow money to buy raw materials or finished goods for stock, or perhaps to tide him over until he collects money due from his customers. A bank also invests in bonds and other securities, most of which can be turned into cash on short notice.

The success of a bank depends primarily on the judgment of its officers in making loans and investments. In the past most of a bank's funds normally went into loans. Today banks invest more money than they lend because there is a much smaller demand for loans.

The funds which a bank can lend or invest come not only from the cash deposited, but from the "promises to pay" deposited by borrowers. Each loan it makes creates additional deposits against which it can lend; in other words, gives it additional credit. The bank



must keep on hand ample funds to provide safety against possible losses on its loans or investments and sudden demands from its depositors. Its capital and surplus provide a margin of safety against such emergencies.

The character of a bank's investments is important, because they are the most "liquid" part of its assets—that is, the part most easily turned into cash. If a large number of depositors should withdraw their deposits and the assets were not easily salable, the bank would be obliged to "suspend payment," or decline to pay. "Runs," as sudden and numerous withdrawals are called, were once common in times of financial panic, when depositors became alarmed about the safety of their money. Today, however, the government guarantees small depositors' accounts.

When a bank fails, a "receiver," appointed by the comptroller of the currency for a national bank, or by the state bank superintendent or commissioner for a state bank, winds up its affairs. Formerly the receiver might assess stockholders amounts equal to the par value of their stock. The Federal Banking Act of 1935 ended this "double liability" of stockholders in national banks after July 1, 1937; many states also have done away with it.

What Are a Bank's Liabilities?

A bank's statement explains what it has done with the money entrusted to it. The "liabilities" it shows account for the money paid in by stockholders and for the "time" and "demand" deposits held by the bank. A time deposit is one which the bank may hold for a specified period. It accepts such a deposit by issuing a certificate of deposit or by taking a savings

deposit. A certificate of deposit states that the money has been deposited in the bank and that the bank agrees to repay it on a specified date. The money can be withdrawn only by the presentation and cancellation of the certificate, but the certificate itself is negotiable.

Savings Accounts

In the United States, savings deposits are accepted at the savings department of a commercial bank, or at a special savings bank. Daniel Defoe, the author of 'Robinson Crusoe', is given credit for suggesting a special bank for savings in 1697, but the first savings bank was not opened until 1765, in Brunswick, Germany.

The first special savings banks in the United States were opened in 1816. They are now common in New York, New Jersey, and most of the New England states, but rare in other sections. They are regulated by the states, which prescribe what type of investments may be used for bank funds. Savings accounts, whether kept in a special savings bank or in the savings department of an ordinary commercial bank, are useful for smaller amounts, and for special purposes, such as Christmas or vacation expenses. The banks reserve the right to require notice, varying from 30 to 90 days, from the depositor, before paying out money in savings accounts.

An initial deposit of one dollar is enough to open a savings account in most banks. Whenever money is deposited or withdrawn the depositor fills out a printed form, called "deposit slip" or "withdrawal slip," which gives his name, the amount paid in or taken out, the date, and the number of his account. These slips the bank keeps. The depositor receives from the bank a "pass book," in which are recorded the deposits and withdrawals and the current balance. Banks ordinarily will not pay out savings except on presentation of the pass book. In small banks, where the banker knows every customer by sight, there is little danger that the money will be paid to an unlawful owner, but the bank is not liable if the pass book is lost and later presented by an unlawful holder.

The rate of interest on savings deposits has varied from 5 per cent to 1 per cent or nothing, according to the business conditions and local customs. Interest is usually credited on January 1 and on July 1. As most of the money deposited in savings banks is invested in bonds, the rate of return received by the bank on these investments determines the rate which it can afford to pay on its deposits. The difference between the average rate received from bonds and the rate paid on deposits is the major source of the bank's profits. Sometimes savings banks are not owned by stockholders, but by the depositors. These are called "mutual savings banks" and any profit made by them is prorated as dividends, usually once a year, among the depositors. Postal savings banks, operated by the government postoffice department, were first established in England in 1861, in Canada in 1867, and in the United States in 1910. In the United States, two

per cent interest is credited on balances up to \$2,500, which is the maximum accepted from any depositor.

Checking Accounts

If, instead of wishing to keep your money in the bank indefinitely, you wish to have it immediately available, you open a checking account. In small banks \$25 or \$50, in large banks \$200 to \$500, is the minimum average balance you will be expected to keep on deposit. The records of a checking account are kept in ledgers or on ledger sheets, just as for a savings account, so that the bank can tell at any moment how much money you have deposited, how much you have withdrawn, and how much is left. Checking accounts are the bank's "demand" deposits. United States banks will not honor your demand for more money than you have in the bank. Formerly, those whose credit was good might draw out sums in excess of the amount in their accounts, but "overdrafts" are now prohibited by state and federal banking laws.

Money is withdrawn from a checking account by means of a written order (called a check), dated and addressed to the bank, instructing it to pay to a person named, or to the bearer, a certain amount. Even if you wish to withdraw money from your own account, you must present a check, signed by you, and made payable to yourself or to bearer. The bank supplies each depositor with printed checks, but if you happen to be out of the printed forms, and write out the entire order in longhand, the bank will pay it. A check (also spelled cheque) is the commonest form of credit instrument (see Credit).

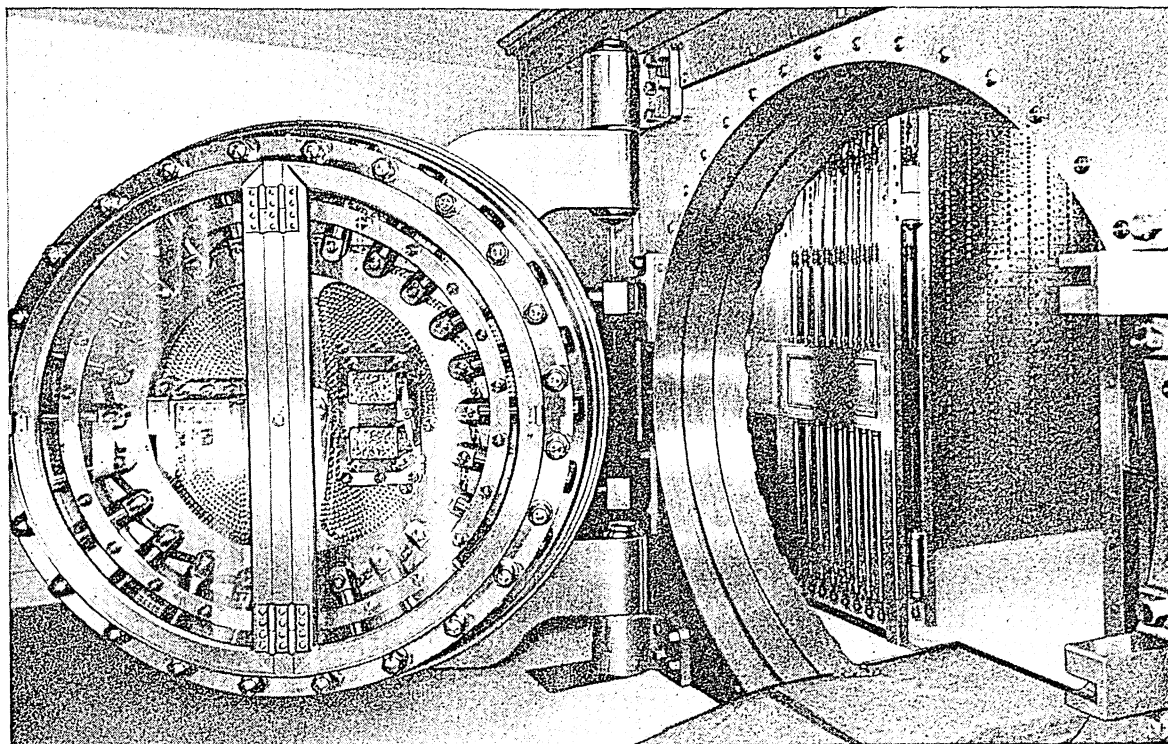
When the drawer of the check has not enough money in the bank to pay it in full, it is usually not paid by the bank on which it is drawn, but is sent back to the payee. Checks may be returned for other reasons, such as no signature, or no date, or a discrepancy between the written words of the amount and the figures. To avoid this danger it is common practise, when large amounts are involved, to have the check "certified" by the bank on which it is drawn. This is done by stamping across the face of the check "Accepted, _____ Bank," and having an officer of the bank sign the certification. A certified check is immediately charged against the maker's account, and becomes a liability of the certifying bank.

In business transactions a "cashier's check" is sometimes substituted for a certified check. A cashier's check is the bank's own promise to pay. It passes by indorsement like a personal check, but, unlike a certified check, it does not show on its face out of whose account the money will be paid.

Liabilities to Stockholders

So far, in the consideration of a typical bank statement, you have considered only one item, deposits, and the transactions and instruments which arise from them. Capital, surplus, and undivided profits are liabilities of the bank to its stockholders, not to depositors. If a bank is in difficulties, and if its assets are not sufficient to pay depositors in full, then these

THE TREASURE "CAVE" OF A MODERN BANK



Concrete and steel guard the safety deposit vaults where the bank and its customers lock up their valuables. That huge door, that looks like the breech-block of a giant gun, is proof against drills and dynamite. Behind those two semicircular panes of glass is the mechanism of the time-lock. Once the 24 bolts in the door's rim are driven out and catch on the inside of the steel door casing, they cannot be drawn back until the chronometer in the door marks the official opening hour.

three liabilities to stockholders may be wiped out by using the assets to pay depositors. Capital represents the face or par value of the bank's stock, usually at \$100 a share. Surplus may be "paid in" or "earned." If it is paid in, this means that the stockholders, when the bank was organized, paid a premium over par for their stock. This surplus is an added protection to the depositors. If it is earned surplus, this means that the directors, instead of paying out each year all the profits the bank has made, have held back a part for use in the business. The distinction between surplus and undivided profits is not always clear, both being profits retained in the business, but dividends to stockholders may be paid out of undivided profits and reserves, although not usually out of surplus.

Reserves, Loans, and Discounts

Reserves are often set up on the bank's books to offset possible losses. Then if the loss occurs, the bank will not be suddenly embarrassed by a decrease in estimated profits, and if it does not occur the profits will actually be increased. A reserve is merely an accounting device for insurance against future losses.

In accounting, an asset or a resource need not represent actual property; it may merely explain what has happened to it. Such a resource is the largest item on the asset side of the bank statement, namely, loans and discounts. A large bank divides loans and

discounts into three groups: demand loans, which the bank may require paid at any time; time loans, on which the date of payment is specified; and real estate loans, if there is a substantial percentage of these.

Some banks show a division of loans as "collateral" and "other loans." Anybody who owns bonds or shares of stock in a well-known corporation or has a warehouse receipt for grain, or some other evidence of property, may deposit it with a bank as collateral security, and borrow money against it. Usually a bank will lend 60 to 80 per cent of the market value of the collateral. Then if the borrower fails to pay his loan, the ownership of the collateral reverts to the bank, which may sell it, returning to the borrower any excess over the amount of the loan, or holding the borrower liable for the difference if the collateral is sold for less than the amount of the loan.

Business men, however, do not always have collateral available. A large packing company, for example, may borrow millions of dollars from the banks on its credit, without pledging specific collateral. In such a case the bank takes the risk that the net assets of the company would pay the loan. When loans are made on credit, the bank is much more careful than when loans are made on collateral. It takes into consideration not only the financial condition of the borrower, usually requiring a statement of his assets and liabilities, but also considers his character, his stand-

ing in the community, his record in business, and his probable success in the present enterprise.

How the Clearing House Operates

After loans and discounts, the largest item on a bank statement should be cash on hand and due from banks. These two are usually lumped, because cash due from other banks is so certain to be paid that it is fair to treat it as cash. The phrase "due from banks" usually includes "clearings," a word which requires a long explanation. Obviously if there is only one bank in a community, all deposits and loans are made in that bank. If there are two banks, or in large cities dozens of banks, then some machinery must be set up to cancel the obligations of banks to each other as a result of the transactions of their customers or depositors. The chart on this page explains a simple example of such "clearing house" work.

In small towns, and in early days even in larger cities, it was customary for each bank, at the close of the day's business, to send messengers to the other banks and get from them the cash to cover the checks on those banks which the particular bank had received during the day. It is a legend, probably not true, that two London messengers, happening to meet at a coffee house, decided that it was easier to exchange checks there than for each to take the long walk to the other's bank. Gradually other clerks learned of this practise, and the coffee house became an unofficial clearing house. The London clearing house began to function formally about 1775, and moved into its own building in 1810. The New York clearing house, largest in America, was organized in 1853.

The clearing houses in the United States perform many vital functions about which the public knows very little. All members of the clearing house association have their accounts regularly audited by examiners, appointed by the association. This audit is in addition to the bank's own audit and the audit made by the state or federal bank examiners. The clearing house association has helped to eliminate bad banking practise among its members, and has helped weak banks through difficulties.

There is no super-clearing house to clear checks between cities. If you deposit a check in your bank drawn on a bank in another city, it is forwarded by your bank to its "correspondent" in the other city, and is there sent through the local clearing house. The funds may then be kept to the credit of your

bank on the books of the correspondent, or they may be transferred to some other bank as your bank may direct, but almost never is there any actual transfer of currency. For its services in collecting out-of-town checks, a bank may charge a small fee, usually from five to twenty-five cents, called "exchange." Banks which belong to the federal reserve system may have out-of-town checks collected through the federal reserve banks without charge (see Federal Reserve Banks).

State and National Banks

Banks in the United States may be organized either under the authority of the national government or of any of the states. National banks receive their charters from the Treasury Department, and their books are audited periodically by examiners appointed by the comptroller of the currency. The bank, however, is not run by the government, and the latter is not liable for its debts. State banks are chartered by the state and operate under state laws. There are also private, or unincorporated, banks, conducted by individuals or partners; but the Banking Act of 1933 required such banks to permit examination and publication of their financial condition. The powerful New York house of J. P. Morgan & Company was a private bank until 1940, when it became a state bank. The 1933 law also forbade so-called "investment bankers," who really are dealers in securities, to receive deposits,

and forbade banks to deal in securities, because the desire to sell securities sometimes led to bad banking practises.

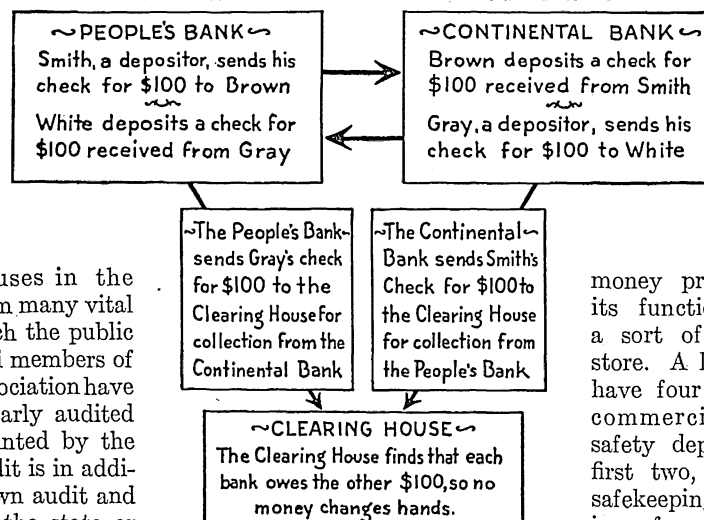
Other Departments

The large bank, because it deals with all kinds of money problems, has extended its functions until now it is a sort of financial department store. A large bank usually will have four distinct departments: commercial banking, savings, safety deposit, and trust. The first two, which deal with the safekeeping, borrowing, and lending of money, have been fully described. The safety deposit department was an obvious outgrowth of the bank's need for

guarding its own treasure. Customers were first allowed to keep their valuables in the bank's vaults; later, a special box was provided for each customer, to which he alone had access, and for which he paid rent.

Modern safety deposit vaults are almost impregnable. The largest of them have an outer wall of reinforced concrete, from 8 to 18 inches thick, entirely enclosing a steel wall, built of two or more plates,

HOW BANK CHECKS ARE "CLEARED"



A simple example showing how the Clearing House balances the checks received from one bank against those of others, to prevent, so far as possible, the transfer of cash.

each an inch thick. Sometimes highly sensitized telephonic microphones are attached to the steel plates. Even the lightest tap against the vault walls will cause the microphones to set off a police alarm.

The next step in the development of the financial department store was the trust department. So far the typical bank was handling its customer's affairs with his full knowledge and only at his request. It was logical to say to a customer that the bank could take care of all these details without bothering the customer—for example, if he left town for several months, or even after his death. A vast trust business will handle financial affairs ranging from clipping coupons and collecting dividends to managing estates and business enterprises (*see Trusts*).

The United States Banking Act of 1933, in addition to requiring examination of all banks, created a Federal Deposit Insurance Corporation, with 150 million dollars subscribed to its stock by the government, and further subscriptions from the Federal Reserve banks and members of the federal reserve system. The Banking Act of 1935 provides for insurance of deposits up to \$5,000 in all banks which are Federal Reserve members. Non-member banks may obtain insurance if their financial condition is approved by the Insurance Corporation. But state banks with deposits of \$1,000,000 or more, after July 1, 1942, must be Federal Reserve members to obtain insurance. Insured banks must contribute annually $\frac{1}{12}$ of one per cent of their total deposits to a fund for paying depositors of any bank which cannot meet its obligations.

What Happens When a Bank Fails

How can a bank fail, when its "statement" gives no warning? The reason is, the statement shows book values, or costs, of the assets, and not the current or actual value. The money may have been used to buy bonds which are now depreciated and cannot be sold except at a loss. It may have been used to make loans on real estate which is no longer worth the original cost on which the loan was based; and even if it were, it could not be sold during a depression such as began in the United States in 1929. Or the money may have been loaned to men or corporations for use in business, and the borrowers may have been unable to repay the loan when due.

Meanwhile, what are the depositors doing? As they ask for their money, either because they need it or because they are afraid that the bank will close, the bank must sell some of its assets or retire loans. Naturally, the first loans paid and the first assets sold are the best, those which are most liquid and show no loss. As the deposits continue to be withdrawn, there may come a time when the assets remaining can not be sold except at such a loss as would not pay the remaining deposits in full. Perhaps some of the assets can not be sold now at any price; they are "frozen." When such a point is reached the bank must be closed, to allow time to dispose of the assets, and

also that all the depositors may share in such cash as becomes available when the assets finally are sold.

History of Banking

Banking is as old as history, although it was once frowned upon because the taking of interest was considered immoral, and some nations forbade their citizens to engage in it. The temples of Babylon, Egypt, and ancient Greece were the safe-deposit vaults of their day. Money-lenders are mentioned in the most ancient Hebrew history. A Roman ordinance of 210 B.C. set aside a place in the Forum for the money-changers who bought and sold foreign coins. The Justinian code of 553 A.D. included laws governing the lending and trading in money. For more than two centuries from 1100 the Templars engaged in almost all the functions of the bankers of today. The money-changers of Italy in the Middle Ages did business in the street from a bench, in Italian *banco*, which gives us our word bank.

Modern banking may be dated from the Banco di Rialto, established at Venice in 1587. It accepted demand deposits, and permitted the depositors to transfer their credits by checks. It was absorbed in 1619 by the Banco del Giro, which gave receipts for gold or silver coins deposited. The receipts were used as money. This bank survived until Napoleon liquidated it in 1805. The Bank of Amsterdam, organized in 1609, also issued credits for deposits which served for what was called "bank money."

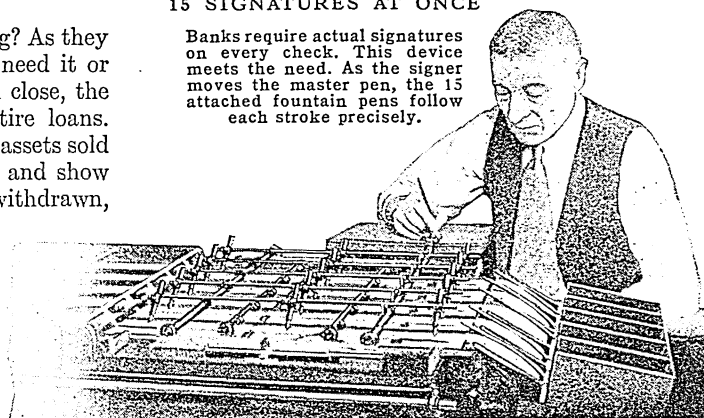
The first real bank notes were issued in 1661 by the Bank of Sweden to eliminate the handling of copper coin. Goldsmiths were the bankers of England until the Bank of England was incorporated in 1694 with a capital of £1,200,000. Except for private bankers, it held a monopoly of banking in England until 1825. The Bank of France was formed in 1800. Germany, Sweden, and other states of Europe now have large state banks or central banks which act as agents for the government in its financial affairs.

Banking in the United States

The first regular bank in the United States was the Bank of North America at Philadelphia, chartered by the Congress of the Confederation in 1782. In

15 SIGNATURES AT ONCE

Banks require actual signatures on every check. This device meets the need. As the signer moves the master pen, the 15 attached fountain pens follow each stroke precisely.



colonial days there were a few small local organizations which issued notes against mortgages, dwellings, live stock, and other security, but they did not carry on a general banking business. The various colonies issued their own paper money, and the states continued the practise until the adoption of the Constitution in 1789 (see United States Constitution, Article 1, Section 10).

Alexander Hamilton was largely responsible for the creation of the first Bank of the United States, which was chartered by Congress on Feb. 25, 1791, for 20 years. The government took \$2,000,000 of the authorized capital of \$10,000,000, and notes of the bank were made acceptable for all debts due the government. Its greater capital, its eight branches stretching from Boston to New Orleans, and its close connection with the government enabled the Bank of the United States to dominate the country's banking. The government sold its stock, however, and the bank's charter was not renewed in 1811 because of opposition from the 80 or more state banks.

In the next five years state banks multiplied, and turned out more than \$60,000,000 in paper currency. During the War of 1812 nearly all of the banks suspended payment of specie against their notes. The country's finances were in such a critical condition that Congress reversed its decision of 1811 and again chartered a strong central bank, the second Bank of the United States, in 1816. The government subscribed one-fifth of the \$35,000,000 capital and made the bank the official depository of government funds. It prospered until its officers mixed in politics, and incurred the enmity of President Jackson (see Jackson, Andrew). He vetoed the bill to renew its charter, and ordered government funds withdrawn, but the bank continued under a Pennsylvania state charter until it was wrecked in the great financial panic of 1837.

That panic wiped out more than 100 state banks which had loaned large sums, including government funds, on speculative securities. State banks were the only recognized banks until the Civil War broke out in 1861, and some of them issued as many as six different varieties of notes. It was so difficult to know what notes might be of actual value that there was a general discount on all paper money, running sometimes as high as 15 per cent. Counterfeit money, and money issued by "wildcat" banks—banks with no real securities behind their notes—made the general financial confusion worse.

National Banks

The present system of national banks in the United States grew out of the government's need of credit in the Civil War. A law passed in 1863 permitted banks to organize under a national law and to issue notes up to the amount of their capital, secured by government bonds deposited with the Treasury. In 1864 the law was replaced by another which established a bureau in the Treasury Department to supervise national banks, with a comptroller of the currency in charge. A minimum capital of \$50,000 for

banks in places having less than 6,000 population was and still is required. In 1933 the minimum requirement for new national banks was set at \$100,000 for places between 6,000 and 50,000 population, and \$200,000 for banks in larger places.

State banks were slow to join the national system until the law of 1865 levied a tax of ten per cent on all state bank notes. This brought many state banks into the new system. After the panic of 1907, and again after the first World War, there was a trend toward centralization of banking power. This was due first to creation of the Federal Reserve System (see Federal Reserve System), and then later to the spread of branch banking. A few states do not allow banks to operate branches, but most of them permit branches in the city in which the main bank operates. Branch banking has reached its greatest development in California, which permits state-wide branches. Over half of the bank resources of the country are included in branch systems. A federal law permits national banks with \$1,000,000 or more capital to maintain branches in foreign countries.

Chain banking, or group banking, serves practically the same purpose as branch banking. A chain consists of many banks owned by one large bank or by an affiliation of corporations. Canada has a nation-wide system of branch banking really dominated by four banks. There are only about a dozen main banks chartered in the Dominion, with some 4,000 branch banks.

The banking crisis of 1933 (see Roosevelt, Franklin D.) forced the temporary closing of all banks throughout the United States. No bank was allowed to reopen until it had been examined and found in good condition. About 4,500 banks failed to reopen, and the country was left with some 15,000 banking institutions, having assets estimated at the time as worth well over 50 billion dollars. About two-fifths of them were national banks. Only a small proportion of the state banks then belonged to the Federal Reserve System; but provisions in the Banking Act which followed the crisis, such as deposit insurance, put strong pressure on all banks to join the system.

Small-Loan Institutions

Commercial banks as described above seldom provide accommodations for the small borrower who has no assets except his earning power. To meet his emergency needs, many kinds of small-loan institutions have arisen, which lend money on unsecured notes, sometimes requiring salary assignments, indorsement by friends of the borrower, or a *chattel mortgage* on his furniture or automobile.

Most states regulate the small-loan business by laws against "usury," that is, exorbitant interest charges. In spite of these laws, "loan sharks" still charge usurious rates by including "service charges," by deducting interest in advance, and by charging interest on the entire sum loaned for the whole term of the loan while the borrower repays in weekly or monthly instalments. To help the small borrower, some banks have established small-loan departments which lend

to trustworthy persons at commercial rates. Such loans are often substituted for instalment buying.

Credit Unions

Loans which depend for their security chiefly on the good character of the borrower are best made by persons who know him. Federal or state *credit unions*, or coöperative small-loan banks, furnish loans from funds supplied by neighbors or fellow workers, at low rates and without red tape. As few as seven members can pool their funds, incorporate under federal laws, and lend members' money to members. *Labor banks*, organized by labor unions, have grown to include thousands of members with millions of dollars in deposits. Federal credit unions, which are under government supervision, are owned and controlled by their members, who must have some close bond of association or occupation. A committee of members approves all loans. Members' dividends are limited to 6 per cent. (See

also *Banks and Banking* in the FACT-INDEX at the end of this volume. For a list of terms commonly used in banking and other forms of business, see *Economics* in the FACT-INDEX.)

BANYAN TREE. This remarkable tree of India and tropical Africa sends down from its branches great numbers of shoots which take root and become new trunks, so that a single tree may spread over a very large area. A specimen in the Calcutta botanical garden, about 100 years old, has a main trunk 13 feet in diameter, 230 trunks as large as oak trees, and over 3,000 smaller ones. It is said that once upon a time 7,000 people stood beneath this natural temple. The banyan often grows to a height of over 70 feet, and lives through many ages, though its original trunk may decay leaving the younger ones to support the tree. It has large heartshaped leaves and inconspicuous blossoms followed by cherry-like scarlet fruit which furnishes food for the birds and monkeys that live among its branches.

Among the Hindus the banyan is held sacred, and its bark is considered to be a great tonic. The wood is light, porous, and of no value. Scientific name, *Ficus bengalensis*.

BARBADOS (*bär-bä'dōz*). Although the self-governing British island colony of Barbados, the easternmost of the West Indies, is no larger than an average United States county, its nearly 200,000 inhabitants make it one of the most densely populated regions in the world. Its palm-shaded roads are lined almost

continuously with pink-tinted cottages or huts with roofs of ragged thatch. Many of the negro men emigrate because of the pressure of population, and so three-fifths of the inhabitants are females, who are to be seen everywhere skilfully carrying on their heads the goods they have for sale.

A TREE WITH THOUSANDS OF TRUNKS



Here truly, in this banyan forest, is a case where you can hardly see the wood on account of the trees. One tree has so many trunks that the parent is almost lost in its own wilderness.

Negroes outnumber the whites about thirteen to one, but Barbados has solved the race problem, and there is no color line except that the races do not mix socially. Negroes have equal rights in the schools, in the churches, and in politics, and hold many important posts. Civility and good humor seem to be universal, and law and order always prevail.

England obtained the island by settlement about 1625. The colony is administered by a governor, an executive council, and a legislative council, all appointed by the British government, and a house of assembly elected by the people. The capital is Bridgetown.

Coral reefs fringe the coasts of Barbados. The surface, broken by a few forests and streams, is elevated in the interior, where Mt. Hillaby rises to 1,104 feet. Most of the island (area, 166 square miles) is under cultivation, chiefly for sugar cane, but also for cotton, coffee, and tobacco. It enjoys a healthful climate, which is especially beneficial for those with lung diseases. George Washington's only journey abroad was to take his sick brother there in 1751. Hurricanes sometimes take a fearful toll of lives and property. Barbados (the Spanish word for "bearded") probably takes its name from the bearded fig tree which grows there.

BARCELO'NA, SPAIN. When you wander about in Barcelona—the country's chief manufacturing center and largest seaport on the Mediterranean—you find yourself in a cosmopolitan city of the modern

world. Picturesque remains of its ancient splendor are still to be seen in the "old town" with its narrow streets, medieval churches, and flat-roofed brick dwellings; but for the most part Barcelona is so different from the quaint old cities characteristic of Spain that it seems a city apart, given over to business.

Built on the sloping edge of a small plain, between the rivers Besos on the north and Llobregat on the south, Barcelona lies along the Mediterranean in the shape of a half moon. The "new town" to the north, built on a regular plan, has wide streets, handsome modern houses of hewn stone, and gardens of almost tropical luxuriance. The main thoroughfare of the "old town" is the Rambla, which has a fine promenade, with plane-trees planted down the center, and on either side the principal hotels and theaters of the city. On an oval hill at the highest point of the Rambla stands a famous 13th century cathedral, one of the finest examples of Spanish Gothic architecture.

Since early in the Christian era Barcelona has been one of the most important Mediterranean ports. Chief of its extensive industries are the spinning and weaving of cotton, silk, and woolen goods. The World War of 1914-18 gave great impetus to the city's manufactures, for many articles needed in commercial production, which had previously been imported, began to be manufactured there. Many new textile companies and tanneries sprang up, but the greatest growth was in the output of chemical products—dyes, soaps, fertilizers, drugs, etc.—formerly imported from Germany. The chief imports of the city are raw cotton, hemp, coal, grain, and food-stuffs. Fruits, wines, olive oil, textiles, leather goods, machinery, furniture, etc., are among its exports.

Barcelona is said to have been founded by the Carthaginian, Hamilcar Barca, in the 3d century B.C.; it thus acquired its ancient name *Barcino*. It became a colony under the Romans, and in the second century A.D. was the leading market on the western Mediterranean, rivaling Marseilles. It retained its importance under the Goths and the Moors, and in 801 came, with the rest of Catalonia, under Frankish rule. From the 9th to the 12th century its counts ruled it as independent sovereigns. It reached the zenith of its fame in the 12th century, when its merchant ships vied with those of Genoa and Venice, trading as far west as the North Sea and the Baltic, and as far east as Alexandria. But in the early 16th century much of its importance was transferred to ports of western Spain, because of the trade that sprang up with America. In the 17th, 18th, and 19th centuries it came several times under French rule.

During the last year of the Spanish civil war of 1936-39 Barcelona was the seat of the republican government. Many of its buildings, among them the cathedral, were damaged by air raids. The pre-war population was more than 1,000,000.

BARK. Why do we wear clothes, and why do birds wear feathers and fishes scales? For much the same reason that a tree is clothed in bark, only bark is for protection rather than for warmth.

Each species of trees wears a characteristic outside garment so that if we were wise enough we should know the name of the tree by a glance at its bark.

Between the inner bark and the body of the tree is a wonder-working layer of vital cells called the "cambium" that acts like a fairy godmother to the trees. The cambium builds cells on the *inside* that form the year's ring of new wood on the trunk and branches; and on the *outside* it builds layers of cells which make the bark. At first these bark cells are soft and full of living material; but later they collapse, and the busy cambium builds another and another layer of cells inside them, thus pushing them out until they become dry, hard, and inelastic. Since the cambium is always building layers on the trunk of the tree to make it larger around, the pressure of this growth causes the bark to split into ridges, scales, or strips, since it is too dry to stretch. The bark protects the tree in many ways, especially from the attacks of fungi, and it should never be bruised or hacked off, thus leaving the wood exposed.

The bark of many kinds of trees is of great commercial importance, that of oak and hemlock being used for tanning leather. Very important medicines and dyestuffs are made from bark. Quinine, for example, is made from the bark of the cinchona tree, and cascara, which is widely used as a laxative, comes from the bark of the California buckthorn. Stick cinnamon is the rolled inner bark of a small East Indian tree, used as a spice, and cork is the rough outer bark of a species of oak. Almost every boy has learned how to remove the bark on willow twigs by pounding, to make a whistle. The Indians made strong light canoes of the bark of certain birches, and from the pliable fibers of certain other barks savage tribes make rude cloths for rugs and clothing.

BARLEY. The most ancient food of mankind, according to the historian Pliny, was barley, our fourth most important grain. Barley has been found in the excavated lake-dwellings of Switzerland belonging to the Stone Age. Chinese sacred books claim that it was known in China 20 centuries before the birth of Christ, and the ancient Hebrews used the grain while they were in Egypt, for it is referred to in Exodus.

In appearance barley is not unlike wheat, but it will grow in climates too cold for the latter grain. It is cultivated from the arctic region of Alaska to tropical India, and it grows wild in western Asia. As barley ripens in a shorter time than does wheat, it can be sown in the spring later than wheat and harvested before the wheat is ripe. In the United States, barley is grown largely north and west of the limits of profitable corn culture. It needs a well-drained soil but does not thrive on sands.

The well-known varieties of barley belong either to the six-rowed type (*Hordeum vulgare*) or the two-rowed type (*Hordeum distichon*). In dense six-rowed barleys, each of the three one-flowered spikelets borne at each joint of the rachis (axis of the spike or head) is fertile. The so-called "four-rowed"

barleys have loose heads with every spikelet fertile, but have only two regular rows of kernels; the other four so overlap that only four rows appear. In two-rowed barley only the middle spikelet of the three

VARIETIES OF BARLEY



In this picture A and B are six-rowed varieties. A is a commonly grown form in which the two outer rows dovetail together so that they look like a single row. Figure B represents the true six-row, or club, barley. Two-rowed varieties are shown at C and D. C has the "awns," or beard removed. D is a slender variety with awns still attached. The different varieties vary further in color and size of the grain.

matures its kernel. As the "four-rowed" type is poorer in quality, it is raised only in the northern latitudes, to which it is better adapted than the others, as it is extremely hardy.

Barley is not used as a food so much as are other grains, for it has little gluten in it. Still, thousands of peasants in Europe eat the black barley bread. The round grains, called pearl barley, and the patent barley flour are used for thickening soups, for making gruel for invalids, and for modifying cow's milk for babies. The chief use of barley, however, is as stock feed and in the preparation of malt (*see* Malt).

BARNACLE. Individually barnacles are helpless little animals, not much bigger than your thumb; but collectively they can materially lessen the speed of a huge ocean liner.

The common ship barnacle starts out in life independent, active, and able to swim about alone. But

soon it gets tired and fastens upon any support it can find—a rock, or a floating log, or a wooden pile under a pier. There it develops a limelike shell with a movable lid. It likes ship bottoms best of all, however, because they provide it with excitement. Thus barnacles gather beneath the water line of vessels in such immense numbers that they produce a tremendous "drag" which slows down the craft. Ships have to be lifted out of the water from time to time to have their bottoms scraped free of these salt-water pests.

Another kind of barnacle, sometimes called the "acorn-shell," prefers to live on rocks. These may be found in large numbers at low tide, withdrawn into their small houses, waiting for the return of the water which brings them their dinner.

It was believed at one time that barnacles were mollusks, like clams or oysters, but it turned out that they are crustaceans—degenerate relatives of the lobster and the crab. Born free, they start on the down-

LITTLE SAILORS ON A CORK

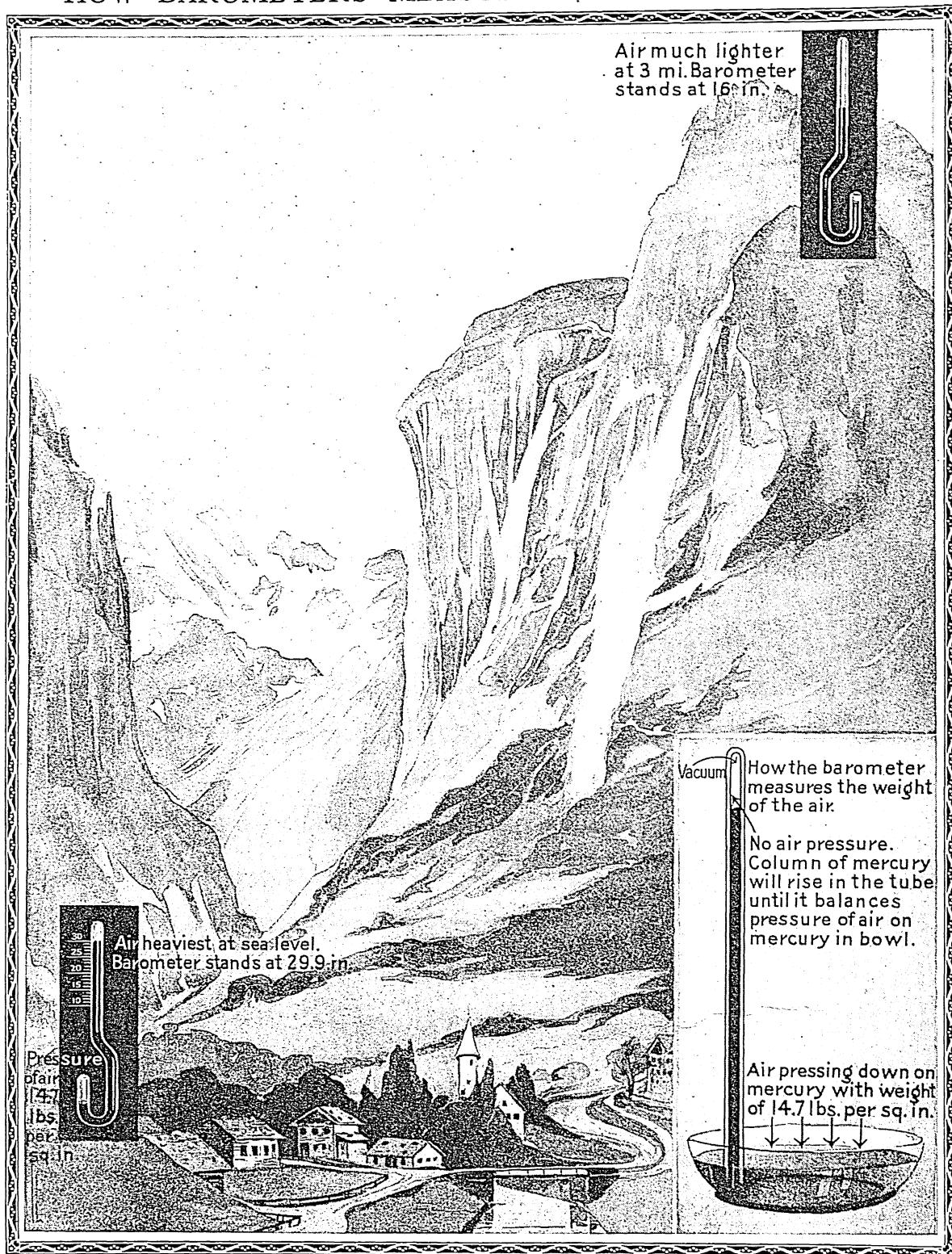


This group of barnacles was found attached to a cork floating in the currents of the sea. You can see how a coating like this all over a ship's bottom would be such a drag that the ship would have to go into dry-dock to have the little pests scraped off.

ward path as soon as they attach themselves to some object. They develop a hard shell and lose their power of motion, except in the six pairs of feathery feet which project from the shell and wave food into their mouths. At the base of the barnacle's shell is a cement gland which provides the powerful "sticking" qualities needed by the creature.

Scientific name of ship barnacle, *Lepas anatifera*; acorn-shell barnacle, *Balanus tintinnabulum*.

HOW BAROMETERS MEASURE MOUNTAIN HEIGHTS



Haven't you often wondered how men learn the height of mountains? You know you couldn't measure straight down through a mountain! This picture shows one way in which it is done. The height of a mountain means its height above sea level. At sea level the barometer stands normally at 29.9 inches. As the instrument is carried up higher and higher, the air pressure becomes less and less until, when you have risen about three miles, it stands at 16 inches. The diagram on the right shows the principle of the barometer. The pressure of the air forces the mercury in the bowl up into the vacuum tube, until the weight of the column of mercury exactly balances that pressure, just as the pound of sugar the grocer puts into the scales balances the pound weight.

BARNUM, PHINEAS TAYLOR (1810-1891). In an age when there were no radios or motion pictures and few other means of public entertainment, P. T. Barnum gave amusement to millions of people. Early in his career as a showman this shrewd and jovial giant of a man decided that "the public loved to be fooled." Typical of his many hoaxes that thousands of people paid to see was the "Fejee Mermaid." This "fake" was contrived by joining the stuffed tail of a fish to the mummified head and shoulders of a monkey. Barnum fooled the public so often that he became known as the "Prince of Humbug." Later in his career, he presented genuine curiosities, which were received with equal enthusiasm.

Barnum was born at Bethel, Conn., where his father was tailor, storekeeper, and farmer. He received little schooling, but his training in strict economy and hard bargaining developed his naturally sharp wits. When he was 14 his father died, and the boy was left to support himself. He clerked in a store. He conducted lotteries. He edited his own small but sensational newspaper. Each type of work taught him more of human nature.

Publicity the Basis of Barnum's Success

His career as a showman began in 1836. His first exhibit was Joice Heth, a Negress who claimed that she had been George Washington's nurse. Other people had made a failure of exhibiting Joice because they lacked Barnum's genius for advertising. He aroused interest in his exhibits by using flamboyant posters, exaggerated descriptive notices, brass bands, and parades. He used high-sounding and mysterious words to stir curiosity, and moreover took care to appeal to people's sentimentality, love of learning, and national pride. Once he was asked to give his rule for success as a showman. With good-natured cynicism, he answered that it was "a thorough knowledge of human nature, which of course included the faculty of judiciously applying soft soap." His publicity methods introduced the era of modern advertising.

In 1841 Barnum bought the run-down American Museum and, by crafty publicity, built it into a New York pleasure center. His most famous attraction was the American dwarf, Charles S. Stratton, whom he named Gen. Tom Thumb. Barnum toured Europe with the General and presented him to Queen Victoria. Another of his famous exhibits was Jumbo, a huge African elephant, which he advertised as the "Only Mastodon on Earth." He achieved a sensation in 1850 by engaging Jenny Lind, "the Swedish Nightingale,"

for a tour of the United States—the first time a foreign singer had been brought to American shores. Barnum's circus career was equally successful. He was not the first circus owner in the United States. But he became the greatest of his time. In 1870 he combined many of

his traveling entertainments into one tremendous circus, "the Greatest Show on Earth." Its traveling expenses were \$5,000 a day. In 1880 he joined his chief rival, J. A. Bailey; and by 1887 the two shows were called "Barnum and Bailey's Circus." (See Circus.)

Barnum several times suffered severe financial losses through fires and unfortunate business connections, but he fought his way back to success—once by lecturing on "The Art of Money-Getting." He was a great temperance advocate, and one season he gave free lectures on temperance. His book, "The Life of P. T. Barnum, Written by Himself", was a candid mixture of trickery and bluff honesty. He built a pretentious oriental home at Bridgeport, Conn., and became mayor of that city in

1875. Among the many distinguished men who were his close friends were Greeley and Mark Twain.

BAROMETER. Many a vessel at sea has been saved because the "ship's glass" warned the captain in time that a storm was approaching. The ship's glass belongs to the family of instruments called *barometers*, named from the Greek words meaning "pressure measurers." They measure the pressure of the atmosphere. The weather man relies on them in his work. The *altimeters* that tell aviators and mountain climbers the height above sea level are members of this family.

We know that the weight of the air above us causes a pressure that at sea level averages about 14.7 pounds per square inch (*see Air*), and that as we climb to higher altitudes the pressure decreases. We know also that, at any given altitude, the movements of hot and cold air that cause weather disturbances alter the atmospheric pressure (*see Rainfall; Storms; Winds*). Thus, by measuring these pressure changes, barometers can give us information both about altitudes and weather.

Barometers are like weighing machines. They measure the weight or force needed on one side to balance the pressure of the atmosphere on the other. The most familiar form is the *mercury barometer*.

The Mercury Barometer

The picture at the lower right of the opposite page illustrates a simple way to make a mercury barometer. Pour about an inch of mercury into a glass dish. Then fill with mercury a 3-foot glass tube which has been sealed at one end. Now close the open end with your



Phineas T. Barnum

thumb, invert it, and plunge it into the mercury in the dish. Then, carefully holding the tube perpendicular with your other hand, remove your thumb. As you do this, mercury will run out of the tube into the dish until the weight of the column of mercury left in the tube exactly balances the outside air pressure. The clear space at the top of the tube above the mercury is a vacuum. If the outside air pressure increases, more mercury from the dish will be forced up into the tube. If the outside pressure decreases, the mercury in the tube will fall.

The exact measure of the air pressure at any moment is the height that the mercury in the tube rises above the level of the mercury in the dish. Under standard conditions at sea level, the height will be 29.92 inches or 76 centimeters. At an altitude of 10,000 feet, the mercury column will be only 20.5 inches high; at 20,000 feet, 13.75 inches; and at 30,000 feet, 8.9 inches.

Variations at sea level caused by the weather may range between 27 and 31 inches. A "rising glass," due to high pressure, indicates fair weather; a "falling glass," due to low pressure, tells of the approach of a storm (see Weather Bureau).

The experiment with the mercury tube was first performed by the Italian physicist, Evangelista Torricelli, in 1643. In the barometers in practical use the open dish of mercury is replaced by a small enclosed reservoir with only a tiny opening to the outside air. Since pressure in any liquid is the same at a given depth, regardless of the size of the container or of its surface area, the shape of the reservoir has no effect on the result. In its simplest form it may consist merely of an upbend of the barometer tube (*siphon barometer*), as illustrated in the lower left-hand corner of page 48. In the Kew, or "marine," type of instrument, the units of the scale at the top are marked to take into account differences between reservoir and tube levels. The *Fortin* type has a device for adjusting the reservoir always to the same level so that the readings may be taken from a uniform scale.

Mercury is used because it is by far the heaviest of liquids. A water barometer would require a tube over 30 feet high. Furthermore, water and most other liquids release vapor that would degrade the vacuum

at the top of the tube, whereas cold mercury releases very little vapor.

The Aneroid Barometer

The form of barometer called an aneroid (from Greek words meaning "non-liquid") consists of two diaphragms of thin, flexible, corrugated metal enclosing a vacuum. One side of this *vacuum box* is fastened to the support of the instrument. The other is attached to a spring. The pressure of the air tends to push in the sides of the vacuum box, but the spring tends to pull them apart. When the atmospheric pressure increases, the spring is pulled inward; when it decreases, the spring moves outward. This slight movement is magnified by a series of arms, as shown in the accompanying diagram.

The aneroid is extremely sensitive, but does not retain its accuracy so well as the mercury barometer. It is used, however, in the many situations where the more cumbersome and fragile mercury instrument would be impractical. Airplane altimeters are almost always of the aneroid type.

The *barograph* is an aneroid barometer linked to a pen which traces changes in atmospheric pressure on a record sheet (see Weather Bureau).

A variation of the aneroid barometer was invented by Eugène Bourdon, French engineer and originator of the Bourdon pressure gauge used with steam boilers. A flattened vacuum tube of springy metal is bent into a circle. The circle tends to close up with greater pressure and open out with lesser pressure. The movement is transmitted to a dial, as in the aneroid instrument.

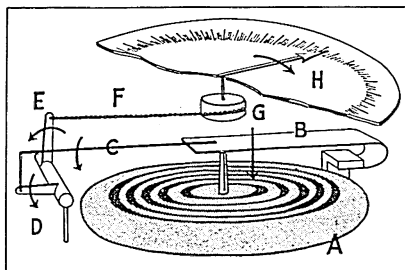
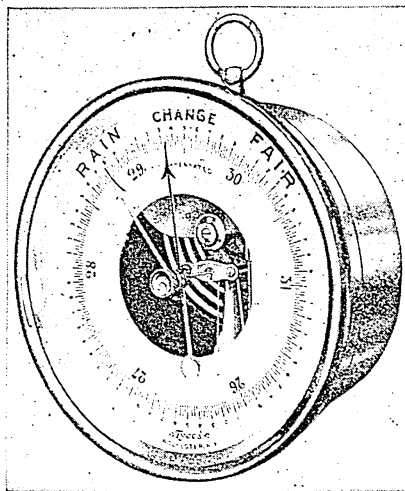
To get weather information from a barometer, the changes due to altitude must, of course, be disregarded. Thus, the weather observer at a mountain station corrects all his readings to what they would be at sea level. Corrections must also be made for the expansion or contraction of the parts of all barometers due to changes in temperature and for differences

in the force of gravity in different latitudes (see Gravitation).

Barometer readings may be reported in inches, centimeters, or millimeters of mercury, or in *millibars*. One millibar is a pressure of 1,000 dynes per square centimeter. The dials of altimeters are usually marked in feet.

BARRACUDA. One of the fiercest of fishes is the barracuda, found in the warmer parts of the Atlantic and the Pacific. It has the savage appearance of the fresh-water pike—a narrow muscular body, a long cruel mouth with undershot jaw, and yellowish green eyes. It is, however, no relative of the pike, and differs from it in having two fins on the back. Specimens

AN ANEROID BAROMETER



The top picture shows an aneroid barometer for weather readings. The dark hand indicates the pressures. By turning the milled knob you set the light-colored hand over the dark one, so that later on you can note any change. The numbers on the dial correspond to inches of mercury in a mercury barometer. The diagram below shows how the mechanism of the aneroid works when the pressure is rising. The top of the vacuum box (A) is forced down and pulls down the spring (B). This lowers the arm (C) which turns the levers (D and E) as indicated by the arrows, and pulls the chain (F). This turns the drum (G) and moves the hand (H) to the right on the dial. When the pressure decreases, all these motions are reversed.

more than six feet long have been caught, but the average is from three to four feet.

The barracuda ranges far in search of food. When it finds a school of fish, it circles about them until they huddle together in fear, then dives into their midst, biting and slashing with its sawlike teeth. Barracudas will strike almost any moving object and are easily caught by trolling. Swimmers have been severely, even fatally, bitten by large barracudas.

Barracudas belong to the family *Sphyrenidae*. About 20 species are known. Scientific name of the great barracuda of the West Indies and Florida, *Sphyrena barracuda*; of the most important California species, *Sphyrena argentea*; of the European barracuda, *Sphyrena sphyrena*. The California species are widely used as food. The so-called Australian barracuda, or barracouta, another valuable food fish, belongs to a different family.

BARRIE, SIR JAMES MATTHEW (1860–1937). From the bleak Antarctic a dying explorer, Robert Falcon Scott, penned his last letter, bidding farewell to his friend Barrie, the famous author. Ten years later, Barrie, in an address at St. Andrews University, quoted part of this letter, to illustrate his theme of "Courage." But with characteristic diffidence Barrie did not reveal that he had financed the expedition and, at its tragic end, had assumed the care of Scott's widow and son. Only a few intimate friends knew the great-hearted generosity of this shy, reserved Scotsman; but countless readers have been delighted by the charm, tenderness, and quiet humor that he gave to the whole world in his stories and plays.

Barrie was born May 9, 1860, at Kirriemuir, Scotland. His father, David Barrie, was a weaver. Though the family was poor, Barrie was educated at Dumfries Academy and Edinburgh University. After college he wrote for several English newspapers, and in 1885 went to London. There he first won recognition by sketches of his native village, which he called "Thrums." His success with these stories in Scottish dialect inspired other writers in the same field, often called the "Kailyard School" of literature.

At this time Barrie wrote his greatest work, 'Margaret Ogilvy', a tribute to his mother. In this story of his early life with her, Barrie reveals himself clearly and without reticence. After 1900, most of his works were plays, which were acted by some of the greatest actresses of England and the United States.

Barrie had an amazing understanding of the feminine mind, whether of high-born ladies or kitchen drudges; but most amazing is the fact, as he himself

tells us, that all his heroines were drawn from his mother.

Best known of all Barrie's creations is Peter Pan, the little boy who wouldn't grow up, who lived in a fascinating world full of Indians, pirates, and fairies. The play, 'Peter Pan', grew out of stories (based on part of Barrie's novel 'The Little White Bird') which he told for some young friends. It was an immediate and lasting success. First presented in 1904, it has been played in London every year since. Its mixture of fantasy, humor, and exciting adventure appeals both to children and to adults. And in book form 'Peter Pan' reaches an even greater audience. Barrie retold the play in narrative form as 'Peter and Wendy'; and parts of 'The Little White Bird' he made into a separate work called 'Peter Pan in Kensington Gardens'. Barrie wanted his creation to delight and benefit children as much as possible, and so he gave a statue of Peter to be placed in Kensington Gardens, and donated all rights in the play to a hospital for sick children in London.

Barrie and his wife (Mary Ansell, whom he married in 1894) had no children, but he adopted the Davies boys, who had been his first audience for the story of 'Peter Pan'.

In later life Barrie wrote little, but many honors came to him. He was made a baronet in 1913, and in 1922 he received the Order of Merit.

Representative Works

Novels and stories—'Auld Licht Idylls' (1888); 'A Window in Thrums' (1889); 'The Little Minister' (1891); 'Margaret Ogilvy', 'Sentimental Tommy' (1896);

'Tommy and Grizel' (1900); 'The Little White Bird' (1902); 'Peter Pan in Kensington Gardens' (1906); 'Peter and Wendy' (1911); 'Farewell, Miss Julie Logan' (1932).

Plays—'The Professor's Love Story' (1895); 'Quality Street', 'The Admirable Crichton' (1902); 'Peter Pan' (1904); 'What Every Woman Knows' (1908); 'A Kiss for Cinderella' (1916); 'Dear Brutus' (1917); 'Mary Rose' (1920); 'Shall We Join the Ladies?' (1922); 'The Boy David' (1936).

BARRY, JOHN (1745?–1803). This naval officer, sometimes called "the father of the American navy," was one of the men to whom the United States owes its beginnings as a world power on the sea. He was born in Wexford County, Ireland. So little is known of his childhood that historians disagree about the year of his birth. He went to sea as a boy and, about 1760, made his home in Philadelphia. There he grew wealthy as master and owner of a ship.

Early in the Revolutionary War (December 1775) Barry received the first captain's commission issued under authority of the Continental Congress, and was made commander of the brig *Lexington*. He

PETER PAN



This bronze statue of Peter Pan, by Sir George Frampton, stands in Kensington Gardens, London.

was the first naval officer to capture a British warship in actual battle, when the British tender *Edward* yielded to the *Lexington* (April 1776). In the winter of 1776-77 he led a troop of volunteers on land in the Trenton and Princeton campaigns. In the spring of 1777 his exploit on the lower Delaware River thrilled the Americans and gave them new heart; with a small force of rowboats he outmaneuvered the British and captured some of their transports, cutting off from their army large quantities of supplies. This brought him warm praise from General Washington. During the closing years of the war, Barry won fame as commander of the *Alliance*, a ship of 32 guns. With the *Alliance* in 1781 he captured the British vessels *Trepassy* and *Atalanta*, after a fight in which he was severely wounded.

Barry's record gave him so much prestige that he was named senior captain when the Navy was reorganized in 1794. This was then the highest post in the Navy. He was popularly called "Commodore." He was made commander of the flagship *United States* and placed in charge of the naval forces in the West Indies. He died in Philadelphia Sept. 13, 1803.

BARTHOLDI, FRÉDÉRIC AUGUSTE (1834-1904). From the decks of ships entering New York harbor, home-coming Americans and foreign travelers eagerly watch for the Statue of Liberty. This colossal figure, whose right hand holds a great torch high over Bedloe's Island, was the work of the French sculptor Frédéric Auguste Bartholdi, a native of Colmar, Alsace.

As a young man, Bartholdi began the study of painting but soon turned to sculpture. Much of his earlier work consisted of portrait busts. After serving as a soldier under Garibaldi in the Franco-Prussian War, he worked on patriotic and symbolic statues, some of which were of gigantic size. His 'Switzerland Assuaging the Sorrows of Strassburg' was presented by France to Switzerland in gratitude for its sympathy during the war. 'The Lion of Belfort', considered Bartholdi's masterpiece, commemorates the Belfort siege in 1871. It is carved from the red rock of a hill that overlooks the city.

To Bartholdi, America was the great pioneer which had shown the whole world the pathway to liberty. The story of how France, largely through the influence of Lafayette, helped the American colonies to gain their freedom inspired some of his best sculptures. One of them, 'Lafayette Arriving in America', was presented to New York City by French residents and set up in Union Square in 1876. Another, 'Washington and Lafayette', stands in Paris.

His 'Liberty Enlightening the World' symbolizes the ideal of both nations. The statue was a gift from the people of France to the people of the United States. The original plan was to present it on the 100th anniversary of the signing of the Declaration of Independence, but the dedication was delayed until 1886. (See Liberty, Statue of.)

BARTON, CLARA (1821-1912). Spirited, impetuous Clara Barton, founder of the American branch of the Red Cross, was like a bright flame that would not be quenched. Her whole life was a crusade, against tremendous odds, to relieve human suffering.

Born on a farm near Oxford, Mass., she was christened Clarissa Harlowe Barton. Though always frail and very small, she had amazing courage and perseverance. When she was only five, a brother taught her to ride half-broken colts. At 11 she nursed an invalid brother, attending him until his recovery two years later.

As a child she had no close playmates. Her solitary life helped to make her so painfully shy that she was afraid to meet people. To correct that timidity, her mother gave her a great deal of responsibility. At 15, with her mother's encouragement, Clara Barton became a teacher. She conquered her shyness so successfully that she taught for 18 years and, in Bordentown, N. J., promoted a free school for the poor.

In 1854 she suffered the first of many periods of nervous exhaustion which her strenuous work often caused throughout her life. Later that year she was appointed a clerk in the Patent Office at Washington, D. C. At the outbreak of the Civil War, she learned that much of the suffering at the front was caused by scant supplies. Single-handed, she organized supply depots for the needy soldiers. Later in the war she served as a nurse and, in 1864, was appointed a superintendent of nurses. She so often served near the line of fire that many called her "the Angel of the Battlefield." After the war, for four years, she headed the government search for missing soldiers.

While in Europe for her health, she did relief work in the Franco-Prussian War and studied the action of the Red Cross. On her return home in 1872 she campaigned to organize a branch in the United States. Other people had failed in a similar effort, but Clara Barton, by tenacious persistence, succeeded in 1881 (see Red Cross). For 23 years she directed Red Cross work in every great disaster. But her quick, commanding temperament prevented her from working harmoniously with associates. She therefore resigned in 1904. In addition to her humanitarian work, she wrote and lectured extensively.

ANGEL OF THE BATTLEFIELD



Clara Barton, founder of the American Red Cross, spent nearly all of her 91 years of life in the service of humanity.

BASEBALL—*The American* NATIONAL GAME

BASEBALL. If Abner Doubleday were alive today he would talk less of Fort Sumter, S. C., than of Cooperstown, N. Y. For in the former place he fired the first Union shot that began a tragic war, but in the latter place he drew the plans that started the American national game.

It was in the summer of 1839, when Doubleday was 20 years old and had just received his appointment to West Point that he proposed changes in the old games of "town ball" and "round ball" which resulted in the creation of a virtually new game. He is credited with introducing the diamond-shaped field, 90 feet on each side; with assigning players to definite positions (though he had 11 men on a team); and with establishing the name "base-ball."

By 1845 boys everywhere in the East were playing Doubleday's game, and in that year the first baseball organization was formed. This was the Knickerbocker Baseball Club of New York. It drafted rules based on Doubleday's game but changed the number of men on a team from eleven to nine. A year later a rival club, the New York Nine, challenged and defeated the Knickerbockers. So rapidly did interest grow that in 1858 the National Association of Baseball Players was formed by 25 clubs from various parts of the country. By 1865 nearly 100 clubs were represented in the association.

One of the most famous of these teams was the Forest City Club of Rockford, Ill. It had some of the early outstanding players, like Pitcher Albert G. Spalding, whose notable collection of baseball literature is preserved in the New York Public Library. So sensational were Spalding's pitching and the play of his teammates that they upset the best teams in the country. Immediately the larger cities began to offer financial inducements to these players. Since baseball was still an amateur game, however, compensation was strictly against the rules. In the meantime baseball spread to the colleges. The first intercollegiate game was played at Pittsfield, Mass., July 1, 1859, Amherst defeating Williams. Baseball, however, remained chiefly an intra-mural game until Harvard's class of 1866

formed a college nine which played Yale and Princeton. Edmund Davis, a Princeton pitcher of this period, is credited with being one of the first to develop control of curves. In 1879 a college league was formed of Harvard, Princeton, Brown, Amherst, and Dartmouth, which Yale joined a year later only after the other five had agreed to bar professionals.

Organization of Professional Baseball

Professionalism definitely came to baseball in 1869 when the Cincinnati Red Stockings team openly announced its determination to pay its players. The result was immediately beneficial, as it did away with false pretenses. The team won 56 victories and played one tie game before crowds that unreservedly endorsed professional baseball. In 1871 eight professional clubs formed the National Association of Professional Baseball Players. Five years later through the tireless efforts of the first great baseball writer, Henry M. Chadwick, and with the aid of Spalding and others, the present National League was founded.

The American League was organized in 1900. It and the National League are the two major leagues. Each consists of eight clubs, as shown in the table at the bottom of this page.

Each major league team plays a 154-game schedule beginning in April and ending in September. Its standing is determined by what is popularly called its "percentage." This is a 3-place decimal, obtained by dividing the number of games the team has won by the number it has played. Thus if a team has won 12 games out of 18 its "percentage" is .667. The team in each league which has the highest standing at the end of the season is declared the pennant winner to represent the league in the World Series. The two pennant winners meet in a seven-game series early in October, and the first team to win four games is declared champion of the world.

Since 1933, the two leagues have also sponsored an all-star game in July. This is not part of regular league competition. It is a game between the best players of the American League and the best players of the National League. The proceeds go toward the care of former players who are aged or disabled.

In addition to the two

THE FATHER OF BASEBALL



An artist's sketch of Abner Doubleday who started in 1839 at Cooperstown, N. Y., the game that has turned into modern baseball.

THE MAJOR LEAGUE TEAMS

| NATIONAL LEAGUE | | AMERICAN LEAGUE | |
|-----------------|------------------|-----------------|------------------|
| CLUB | NICKNAME | CLUB | NICKNAME |
| Boston | <i>Braves</i> | Boston | <i>Red Sox</i> |
| Brooklyn | <i>Dodgers</i> | Chicago | <i>White Sox</i> |
| Chicago | <i>Cubs</i> | Cleveland | <i>Indians</i> |
| Cincinnati | <i>Reds</i> | Detroit | <i>Tigers</i> |
| New York | <i>Giants</i> | New York | <i>Yankees</i> |
| Philadelphia | <i>Phillies</i> | Philadelphia | <i>Athletics</i> |
| Pittsburgh | <i>Pirates</i> | St. Louis | <i>Browns</i> |
| St. Louis | <i>Cardinals</i> | Washington | <i>Senators</i> |

major leagues there are numerous minor leagues with teams in hundreds of American cities. These minor leagues are graded from Class AA to Class E; depending upon the total population of the cities making up each league. There are three AA leagues—the International, composed of Eastern and Canadian cities; the American Association, consisting of mid-Western cities; and the Pacific Coast League.

The major and minor leagues together constitute organized professional baseball, at the head of which is an advisory council composed of a high commissioner, a secretary, and the presidents of the two major leagues. Each major league has its own meetings attended by the owners of the eight clubs. The assets of each baseball club include, in addition to the park and equipment, the baseball players on the team. Players are "sold" or traded from one team to another, sometimes for as much as \$250,000.

Organization of a Baseball Club

In charge of the team is the manager. He is responsible for discipline and frequently directs the strategy on the field. A few managers play on their own teams, but usually they are too old for this. Two of the greatest managers, John J. (Muggsie) McGraw, of the New York Giants, and Connie Mack (Cornelius McGillicuddy), of the Philadelphia Athletics, who for years carried on a famous World Series rivalry, managed from the bench. On the other hand, McGraw's successor, Bill Terry, Detroit's Mickey Cochrane, St. Louis' Frank Frisch, and Boston's Joe Cronin are among those who became successful player-managers.

In addition to a president, a secretary, and a manager, each club has several *scouts*, who go about to minor league cities, college campuses, and amateur playgrounds searching for baseball talent. Bob Feller, one of the greatest pitching sensations of recent years, was discovered on a high-school team. At seventeen he was given an opportunity with the Cleveland Indians and made good. He was permitted to go back and graduate with his high-school class before resuming his pitching duties.

Most players, however, come to the majors by way of the minor leagues. Under the "draft system," the major leagues are permitted each year to draft one player from each of the AA, A-1, and A league clubs, and an unlimited number of players from the B, C, D, and E league clubs. If two or more major league teams seek the same player, the club with the lowest ranking the year before is favored.

Major league players who "slump" either because of age or bad habits are sent back to the minors. Before a player can leave the majors, however, he must be refused ("waived") by every major league club. Frequently a veteran player who is not doing well may improve when traded to another club. For example, in 1914 the Boston Braves acquired several veterans who were considered "through." With these veterans, Manager George Stallings carried the Braves through a successful season, during which the team swept from last to first place and beat the Philadelphia Athletics in the World Series with four straight victories. As a rule, however, players waived are on the down road; they usually retire shortly after.

Opportunities in Professional Baseball

Baseball players are paid well. In the major leagues salaries of \$5,000 to \$10,000 a season are not uncommon. Star players may receive as much as \$50,000 a season. The season as a rule covers the seven months from the end of February to the end of September. The first six weeks are spent in training, usually in the South or in California. When the teams are not in their home cities the players' expenses are paid in addition to their salaries.

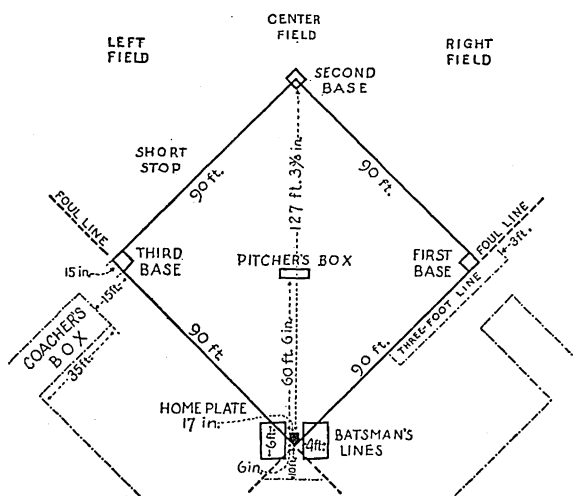
For the ambitious boy who will work hard and keep in training, baseball offers a good career with advancement depending on ability only. Practise and plenty of it will make a good batter, pitcher, or fielder. Major and minor league clubs are on the lookout everywhere for baseball talent, and the boy who plays with unusual skill and intelligence will be discovered sooner or later by a big league scout.

The Field and the Players

The baseball field is laid out in the form of a diamond, as shown in the accompanying diagram. The nine players are pitcher, catcher, first baseman, second baseman, shortstop, and third baseman (composing

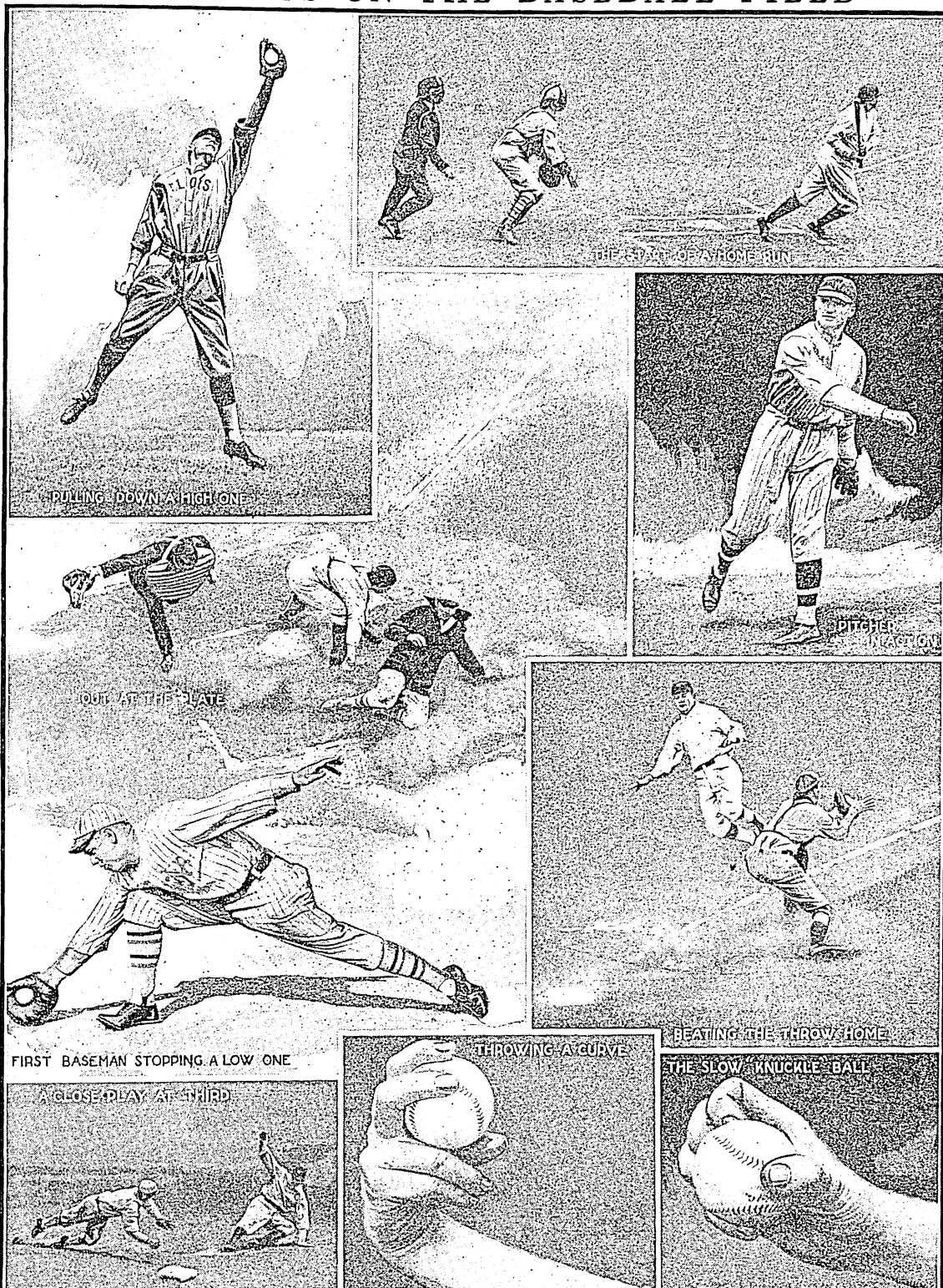
the "infield") and left fielder, center fielder, and right fielder (composing the "outfield"). The catcher stands behind the plate and the second baseman usually occupies the area to the right of second base. The other players cover the positions indicated in the diagram.

The equipment includes the following: a ball, between 9 and $9\frac{1}{4}$ inches in circumference and weighing between 5 and $5\frac{1}{4}$ ounces; a round bat, not more than $2\frac{3}{4}$ inches in diameter at the thickest part, nor more than 42 inches long; mitts of any desired weight and size for the catcher and first baseman;



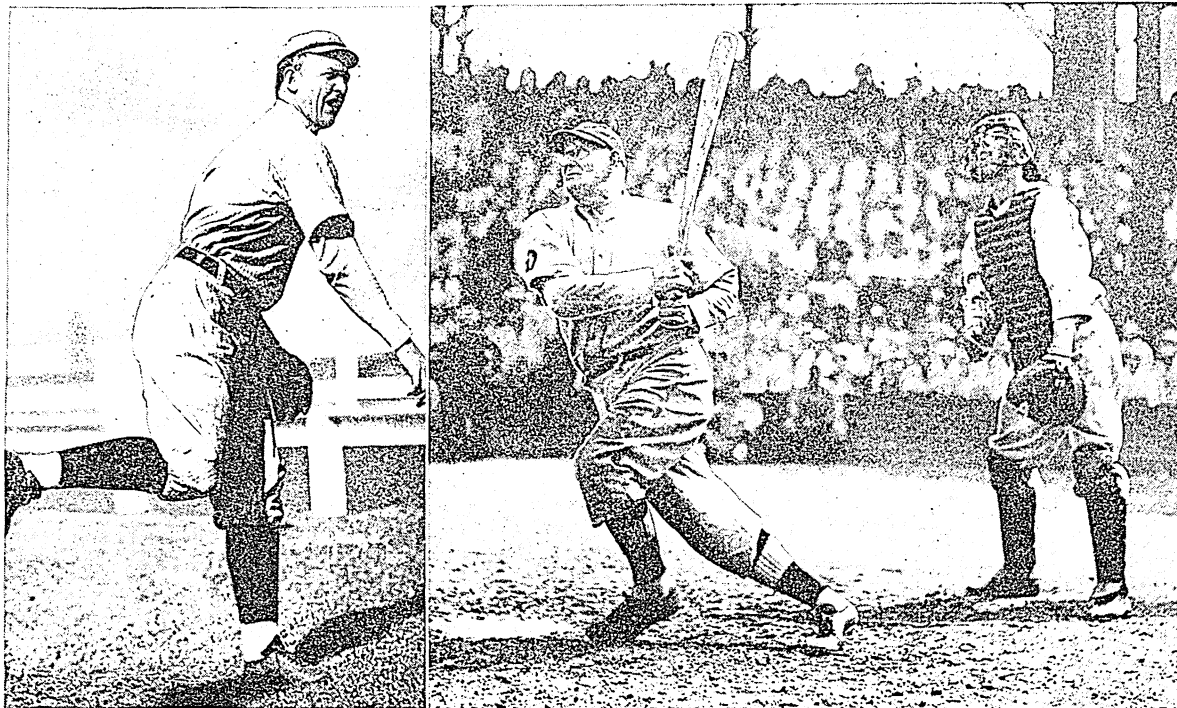
This diagram shows just how a baseball field is laid out and why it is called a "diamond." You are standing back of the home plate and looking out towards center field. The official diamond for boys under 16 years of age is slightly smaller. Its dimensions are 82 feet between bases, 115 feet $11\frac{1}{2}$ inches from home plate to second base, and 50 feet from home plate to pitcher's box.

SNAPSHOTS ON THE BASEBALL FIELD



These photographs of players in action were all taken on the big league diamonds. They show how the masters of the game handle themselves at critical moments. Notice that the moves of these trained athletes, as the flash of the camera caught them, are all easy and graceful. Speed and skill in all sports are always accompanied by smoothness and grace of movement. The awkward player can never excel. Young baseball players should always remember this. When you bat or catch or pitch or run, avoid tricks of form. Do everything in the simplest, easiest way, making every motion as short and direct as possible.

TWO PLAYERS FAMOUS IN THE HISTORY OF BASEBALL



The two players above and the three on the next page were the first to be elected to Baseball's Hall of Fame at Cooperstown, N. Y. At the left is Christy Mathewson, pitcher for the New York Nationals from 1900 to 1916 and famous for his studied control of the ball. Next is Hans Wagner, shortstop for Pittsburgh from 1900 to 1917, who starred at bat as well as in the field.

and for the rest of the players gloves of not more than 10 ounces or more than 14 inches around the palm. The ball is made of a cork center, layers of gray and red rubber, gray and white woolen yarn, and a horse-hide cover.

Playing the Game

The visiting team goes up to bat first. The manager decides in advance the order in which the players will bat, and they must follow that order throughout the game. Usually the heavy hitters bat at the head of the line-up and the weaker hitters at the end.

A run is scored every time a player has made a complete circuit of the three bases and has returned to home plate. To get on base in position to make a run the batter tries to hit the pitched ball anywhere inside the foul lines in such a way that no opposing player can catch the ball before it touches the ground. The batter (now called the "runner") must then reach first base at least, before the ball is recovered and thrown or carried to that base ahead of him. A ball batted safely in this way is counted as a *hit*.

A ball hit far enough to permit the batter to reach first base safely is called a *single*; a hit good for two bases is called a *double* or a *two-bagger*; one good for three bases is called a *triple* or a *three-bagger*. When a ball is hit over the fence, into the bleachers, or very deep into the outfield, the hit is good for four bases or a *home run*.

Thus if the first batter singles and the second batter does likewise, the first batter is advanced to second

base. Then if the third batter should hit a home run, his teammates on bases will score ahead of him for a total of three runs.

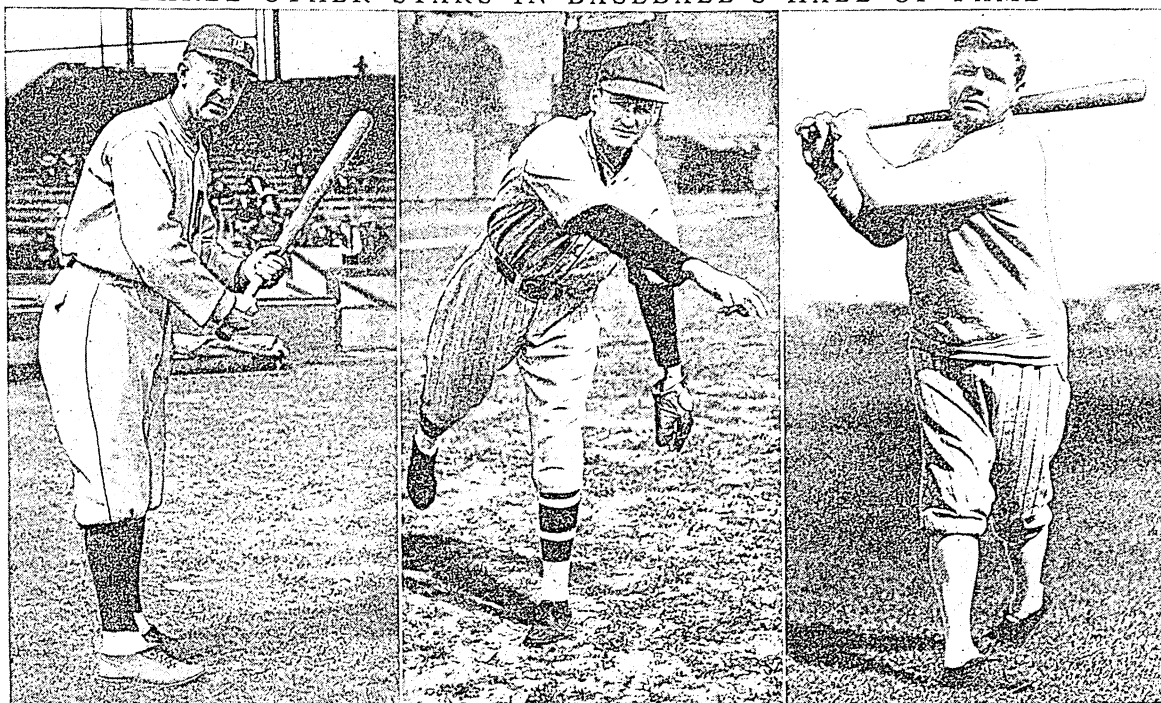
The aim of the team in the field is, of course, to keep the batters from scoring. The pitcher can *strike out* the batter by throwing three *strikes*. A strike is counted when the batter swings at the ball and misses or when the batter fails to swing at a ball that passes over the plate not lower than the batter's knees or higher than his shoulders. A ball knocked into foul territory counts as a strike except when a batter already has two strikes against him, in which case the *foul ball* does not count for anything. But a *foul tip* (ball glancing slightly off bat) when caught by the catcher always counts as a strike.

If the batter knocks a *foul fly*—one that goes up into the air behind the plate or into the field outside the foul lines—and the ball, without striking any obstruction, is caught by an opposing player before it hits the ground, the batter is *out*.

If the pitcher fails to throw the ball fairly across the plate and the batter lets it go by, it counts against the pitcher as a *ball*. If the pitcher throws *four balls* to any one batter, the batter is given a *walk* to first base, that is, he goes to first without having to hit and run. The batter also gets a "free pass" to first, if a pitched ball hits any part of his body, provided he made an effort to dodge the pitch.

The real work of the players in the field begins when the batter hits a fair ball. If it is a *fly* or a *liner*, the

THREE OTHER STARS IN BASEBALL'S HALL OF FAME



From left to right, they are Ty Cobb, famous batter and base runner, who played right field for Detroit from 1905 to 1926; Walter Johnson, pitcher for the Washington team from 1907 to 1927, who is often ranked as the most remarkable pitcher of all time; and Babe Ruth, right fielder for the New York Americans from 1920 to 1932, whose fame grew out of his ability to hit home runs.

fielders try to catch it before it falls to the ground. If it is a *grounder* or a fly they cannot reach, they try to *field* it (that is, scoop it up) and throw it to first base ahead of the runner. When there are other runners on bases, the fielders may put one of them out by catching him between bases and touching him with the ball. In general they will try to put out the man who is nearest home and therefore most likely to score a run. When three men on the visiting team have been put out, the home team comes in to bat and the visiting team takes the field.

As soon as both the visiting and home teams have had three men put out, the *inning* is over. Nine innings comprise the normal game unless the home team is ahead when it is its turn to bat in the last half of the ninth. In that case the game is complete in $8\frac{1}{2}$ innings. If the score is tied at the end of the ninth inning, the teams play additional innings until one team is ahead, or until the game is *called* on account of darkness. Brooklyn and Boston in the National League played 26

innings to a 1 to 1 tie, May 1, 1920, for the longest major league game on record. On the other hand, before nine innings have been played a game may be called by the umpire because of rain, or fire, or for other good cause; and if five or more innings have been completed, the game is counted as a regulation game. If less than

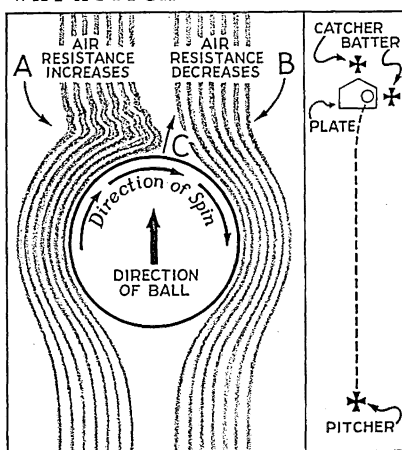
five innings have been played the game is canceled. For gross violation of rules by one team, the umpire may declare the game forfeited in favor of the other team.

The Art of Pitching

The most important man on the defense is the pitcher. Upon his ability depend the efforts of his teammates to keep down the score against them. A good pitcher puzzles the batter by a combination of speed, control, and change of pace, switching from slow to fast and from straight to curve balls with baffling irregularity.

The trick of throwing curves lies in the spinning motion given the ball as it leaves the pitcher's hand. The diagram on this page shows what happens. An in-curve is one that

WHY A PITCHED BALL CURVES



Imagine that you are looking down on a baseball on its way to the plate. The pitcher has given it a clockwise spin, shown by the circular arrows. Now notice that, on the left side, the friction of the ball's spinning surface works *against* the air through which the ball is rushing. This tends to pile up the air at A, and, therefore, increases its pressure or resistance on that side. On the other side, the friction works *with* the passing air. At B, therefore, the air is thinned out, and its resistance decreases. Consequently the ball, following the path of least resistance, curves in the direction of the arrow C. This results in an incurve as the smaller diagram indicates. Reversing the spin of the ball would make an outcurve.

HOW TO READ A COMPLETE BOX SCORE

breaks to the catcher's left; an out-curve breaks to his right. Curves and speed, however, are less important than control.

Perhaps the greatest pitcher of all was Walter Johnson who threw a ball so fast that it could be heard humming. He also had a famous incurve. But it was his superb control that permitted him to strike out more men and pitch more *shutouts* (no run games) than any other pitcher in the history of baseball.

Good habits, constant practise, and a love of the game enabled Walter Johnson to play for 21 years, long after other men of his age had retired. At 48, the "Big Train," as his teammates called him, threw a silver dollar across the Rappahannock River, near the city limits of Fredericksburg, Va., in emulation of a feat attributed to George Washington.

Other great pitchers like Christy Mathewson, Grover Alexander, Cy Young, Lefty Grove, Carl Hubbell, and Dizzy Dean live in baseball history because all of them through long practise acquired control and a change of pace.

The Catcher and the Fielders

The next most important man on the team is the catcher, who with the pitcher forms the *battery*. It is the catcher who stands behind the home plate garbed in a mask, chest protector, shin guards, and a large heavily padded glove. Besides catching the speedy balls the batter lets go by, the catcher often directs strategy. A good catcher knows the opposing batter's weaknesses well enough to signal the pitcher what kind of a ball to throw. The catcher is also in a position to see the whole playing field. Some of the great catchers include Ray Schalk, Gabby Hartnett, and Mickey Cochrane, Chief Myers, who caught for Mathewson, and Doc Ainsmith, who caught for Johnson.

It is the duty of the infield players—basemen and

shortstop—to prevent batted balls from going far out in the field for extra base hits. They are also responsible for tagging out runners on their respective bases, the shortstop frequently covering second. Among the great infielders in baseball's history are George Sisler, John McNinis, Bill Terry, and Lou Gehrig at first; John Evers, Napoleon Lajoie, Eddie Collins, and Frank Frisch at second; Willie Kamm, Harold Traynor, at third; and Hans Wagner, Roger Peckinpaugh, at shortstop.

The outfielders go after the long, high flies or the balls that are batted past the infield. An outfielder needs fast legs to cover the ground and a good throwing arm to get the ball back into play. Among the greatest outfielders of all

time must be listed Tris Speaker, Ty Cobb, Babe Ruth, and Eddie Rousch. Outfielders are counted on for offense also, and as a rule they are the heaviest hitters on a team.

Baseball Strategy

There are many fine points in baseball. Here are some of the most widely used strategy plays:

Sacrifice Hit: With a runner on first base the aim of the batter is to advance his teammate to second, because from there a runner is often able to score on a single. But if the batter hits hard a fielder may catch the ball and put both the batter and his teammate out on a *double play*. To avoid this the batter sacrifices himself by *bunting*, that is, tapping the ball gently inside the base line. The batter will of course be thrown out at first, but the runner will advance safely to second.

Hit and Run Play: This requires great skill on the batter's part. The runner on first starts for second just as the pitcher delivers the ball. Immediately either the second baseman or shortstop must run over to second to cover the base, leaving a gap in the infield. If the batter can hit the ball through that gap he will make a safe hit, sending the first runner on to third or even home.

Squeeze Play: This play is used to score a runner on third,

| GIANTS | AB | R | H | 2B | 3B | HR | TB | RBI | SH | SB | BB | SO | PO | A | E |
|---------------------|----|---|---|----|----|----|----|-----|----|----|----|----|----|----|---|
| Moore, lf. | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Bartell, ss. | 4 | 1 | 2 | 0 | 0 | 1 | 5 | 1 | 0 | 0 | 0 | 0 | 1 | 2 | 0 |
| Terry, lb. | 4 | 1 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 12 | 2 | 0 |
| Ott, rf. | 2 | 2 | 2 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Ripple, cf. | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 |
| Mancuso, c. | 3 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 9 | 1 | 0 |
| Whitehead, 2b. | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 3 | 4 | 0 |
| Jackson, 3b. | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| Hubbell, p. | 4 | 0 | 2 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 2 | 1 |
| Totals. | 31 | 6 | 9 | 1 | 0 | 1 | 13 | 5 | 2 | 0 | 4 | 5 | 27 | 12 | 1 |

| YANKEES | AB | R | H | 2B | 3B | HR | TB | RBI | SH | SB | BB | SO | PO | A | E |
|--------------------|----|---|---|----|----|----|----|-----|----|----|----|----|----|---|---|
| Crosetti, ss. | 4 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 1 |
| Rolfe, 3b. | 3 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 0 |
| DiMaggio, cf. | 4 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 |
| Gehrig, lb. | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 0 | 0 |
| Dickey, c. | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 0 | 1 |
| Powell, lf. | 4 | 0 | 3 | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| Lazzeri, 2b. | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 0 |
| Selkirk, rf. | 4 | 1 | 1 | 0 | 0 | 1 | 4 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Ruffing, p. | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 |
| Totals. | 32 | 1 | 7 | 2 | 0 | 1 | 12 | 1 | 1 | 0 | 1 | 8 | 24 | 7 | 2 |

GIANTS. 0 0 0 0 1 1 0 4 x=6
YANKEES. 0 0 1 0 0 0 0 0 0=1

Earned runs—Giants 4, Yankees 1. Left on bases—Giants 7, Yankees 7. Double play—Whitehead to Terry. Bases on balls—off Ruffing 4; off Hubbell 1. Struck out—by Ruffing 5; by Hubbell 8. Hit batsman—by Hubbell 1 (Gehrig). Winning pitcher—Hubbell. Losing pitcher—Ruffing. Umpires—Pirman (National) at plate, Geisel (American) at first base, Magerkurth (National) at second base, Summers (American) at third base. Time 2h. 40m. Weather—cool, showers.

This is the complete box score of an actual World Series game. The meaning of the initials heading the columns is as follows: AB, at bat; R, runs; H, hits; 2B, two-base hits; 3B, three-base hits; HR, home runs; TB, total bases earned by player's hits; RBI, runs batted in; SH, sacrifice hits; SB, stolen bases; BB, bases on balls; SO, strike-outs; PO, put-outs; A, assists in making put-outs; E, errors. The two lines of figures below the box score show the runs made by innings. To save space, newspapers usually print condensed box scores, consisting of the first three and the last three columns and the columns TB or RBI. The information in the other columns is included in the footnotes.

who starts to run home as soon as the pitcher winds up. Too late to stop himself the pitcher throws the ball which the batter bunts permitting his teammate to score. (If the pitcher balks, that is, starts to pitch and then stops, the runner gets a free base.)

Double Steal: With runners on first and third, the former starts for second as soon as the ball is pitched. If the catcher throws to second to head off the first runner, the one on third starts for home and scores before the ball can be relayed back from second to home.

There are usually two umpires in a game, one behind the catcher, who calls balls and strikes; and one behind the pitcher, who calls plays on the bases. Major league games employ three umpires and the World Series games use four umpires, two from each league.

Scores and Records

Records of all professional games are kept in the form of a summary or box score. An example of a complete box score, with instructions for reading it, is printed on the opposite page. Besides this, the detailed record of each player is kept by his club and by the local newspapers. Chief items in the record are

batting average (number of hits divided by number of times at bat), fielding average (the total of put-outs and assists divided by the total of put-outs, assists, and errors), and the average of earned runs allowed by each pitcher (total of earned runs, divided by number of innings pitched, multiplied by 9).

Baseball's Hall of Fame

The 100th anniversary of baseball was celebrated in 1939 by dedicating a Hall of Fame in the Abner Doubleday Baseball Museum at Cooperstown, N. Y. Here are placed sculptured bronze portraits of famous baseball men. Those who were prominent after 1900 are chosen by the Baseball Writers Association of America. Those prominent before 1900 are picked by a commission from the National and the American Leagues. Ty Cobb, Christy Mathewson, Walter Johnson, Babe Ruth, and Hans Wagner were selected in 1936. Others in the Hall of Fame are Napoleon Lajoie, Cy Young, Tris Speaker, Grover Cleveland Alexander, Connie Mack, Ban Johnson, John J. McGraw, Morgan Bulkeley, George Wright, Alexander Cartwright, Henry Chadwick, Cap Anson, A. G. Spalding, Charles Radbourne, Arthur Cummings, Charles Comiskey, Buck Ewing, Eddie Collins, Wee Willie Keeler, George Sisler, Lou Gehrig, and Rogers Hornsby.

Softball—Baseball's Younger Brother

FOR many years modified forms of baseball have been played in gymnasiums and on small outdoor fields. In these a ball larger and softer than a regulation baseball was used. These games were called by many different names—indoor baseball, kitten ball, diamond ball—depending upon locality and the somewhat indefinite rules that were followed. Within the last few years, these various offshoots of baseball have merged into the nationally recognized game of *softball*.

The Amateur Softball Association of America was formed in 1933, local leagues were organized, and a joint rules committee representing nearly all sections of the country was selected to draw up and publish the official playing rules.

Softball differs from baseball on the following principal points:

Base Distances: The distance between the bases is 60 feet instead of 90 feet.

Pitching Distance: The distance from the pitcher's box to the furthest point on the home plate is 40 feet.

Bat: The bat must not be more than 34 inches long nor more than 2½ inches in diameter.

Ball: The ball must be between 11⅞ and 12⅞ inches in circumference, and between 6 and 6¼ ounces in weight.

Pitching: Underhand pitching only is permitted.

Number of Players: Ten players form a team. To the nine regular baseball positions is added a "short fielder" who occupies a place back of second base.

Innings: The regulation game consists of seven innings.

Base Running: A runner planning to steal a base must remain in actual contact with the base he occupies until the ball has left the hand of the pitcher.

Running Home: No run shall be scored on any play in which the third man is called out for leaving his base before a pitched ball has left the pitcher's hand.

Dead Ball: A ball is dead in case a block ball is declared; if an overthrown ball touches a catcher; in case of an illegally pitched ball, or a ball dropped by the pitcher.

Softball has become so popular that it counts more players than any other American team game. Virtually all schools and public playgrounds find room for

one or more softball fields. The game is fast, and offers plenty of opportunities for developing skill. A good softball pitcher can throw curves with amazing speed and accuracy.

For those who find the regulation game with the 12-inch ball too strenuous, a variation called *slow pitching softball* is played with 14-inch or 16-inch balls. In this game the base lines are only 45 feet long and the pitching distance 31½ feet. The ball must be pitched at moderate speed and runners are allowed to take a lead off the bases. In this game there is greater emphasis on batting and fielding than on pitching skill.

Some Good Books on Baseball and Softball

How Baseball Began. By Robert W. Henderson. (Bulletin of the New York Public Library, 1937, v. 41, pp. 287-91.)

Secrets of Baseball. Told by big league players... Ed. by Mitchell V. Charnley. (Appleton, 1927.)

All Sports Record Book. By Frank G. Menke. Published annually. (All Sports Record Book, Inc.)

Adventures in Sport. Ed. by Louis Persky. (Ginn, 1937.)

Play the Game, the book of sport. Ed. by Mitchell V. Charnley. (Viking, 1931.)

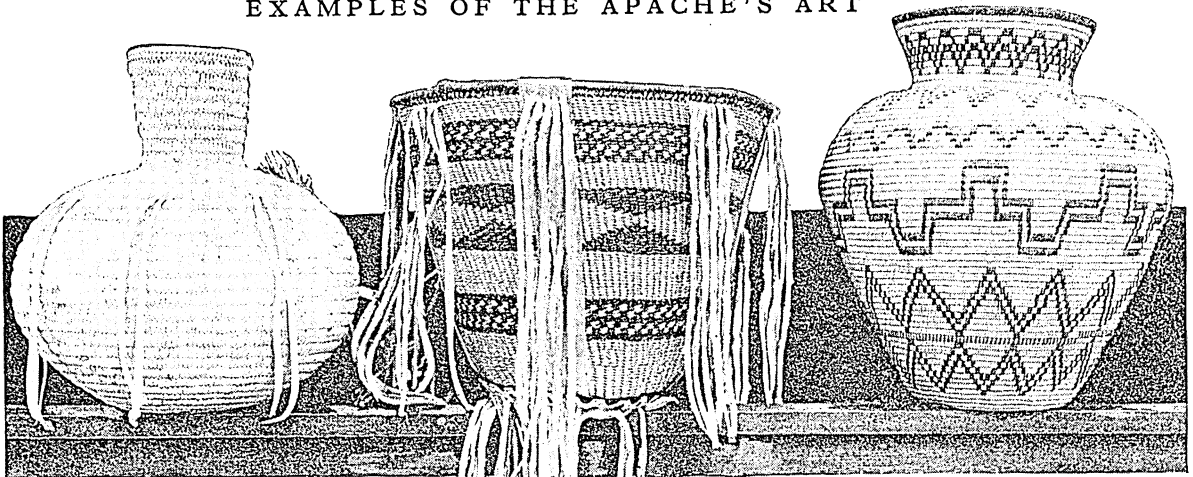
Official Baseball Guide, annual guidebook of rules and records. Spalding's Athletic Library. (American Sports Publishing Co.)

Official Softball Guide, annually prepared by the Softball Joint Rules Committee. Spalding's Athletic Library. (American Sports Publishing Co.)

The history of the game is well told by John Allen Krout in "The Pageant of America", v. 15, pp. 114-47.)

BASKET. Who were the first basket-makers? Probably the birds, whose instinct taught them to weave into cozy nests the materials which nature gave them. Men have learned from them or may have been led by the same instinct to intertwine branches and twigs, stems and rushes, the flexible inner bark of trees, and tough grasses. At any rate they first used basketry, like the birds, to build their homes, for rude huts fashioned in this way were among the earliest forms of shelter. Then later, but still so long ago that we have no idea how far back in the dim and distant past it was, they learned to weave these

EXAMPLES OF THE APACHE'S ART



materials into useful and beautiful vessels for storing and carrying food, and for many other purposes.

Baskets made 6,000 years ago have been dug up from the dry sands of Egypt. When the Romans visited Britain in the first century before Christ, they found the natives already very proficient in the making of baskets of willows, or osiers, much like those still made there today. Indeed it is from these early Celtic inhabitants of Britain that we get our English word "basket."

Basket-making has been found among all primitive peoples and is one of the most ancient of all the arts. As the earliest form of weaving, it may be regarded as the parent of cloth-making and all other textile industries. It is related to pottery, also, for the first clay vessels are believed to have been made by smearing clay on baskets and baking in the fire.

Among the American Indians, especially the western tribes, the art of basket-weaving reached its highest development and was of the greatest

Apache basket water-jars like these are made water-tight by coating with thin pitch. The outside is kept white with white earth. Thongs of leather or plaited hair are frequently added for carrying.

importance. The new-born babe was placed in a cradle woven of basketry, and baskets were used in the burial of the dead. Almost every domestic necessity was supplied by the basket. They were even used to carry water. "How can water be carried in a basket?" you will ask. Some of the water-baskets were coated with gum to make them water-tight, but others

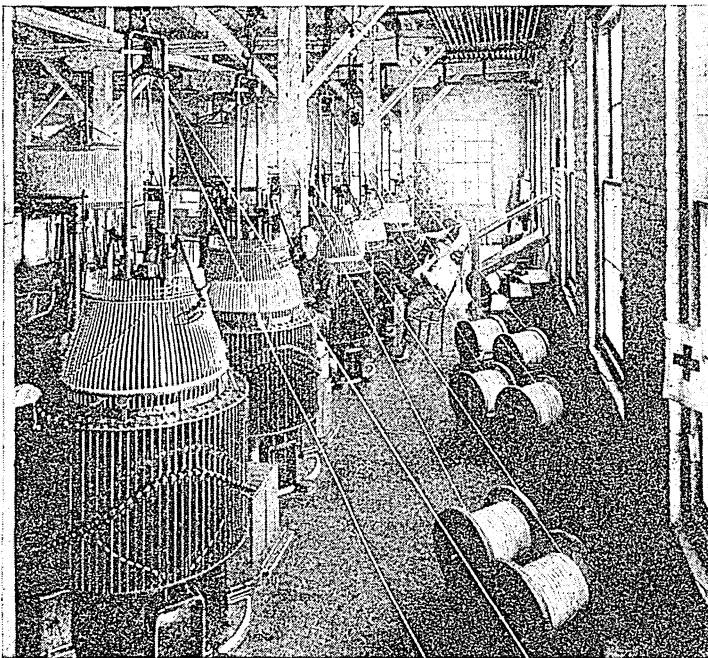
were so tightly woven that even without this coating they would hold water. With or without a lining of clay, baskets were used in cooking; of course they could not be placed over the fire, but hot stones were dropped into them to bring the water in them to a boil.

Basketry was also used in making various articles of clothing. Sandals made of it were used by some tribes instead of moccasins of hide. Head baskets, serving for protection from the sun and rain as well as for adornment, were the predecessors

of the straw hats we now wear in summer.

Captain John Smith speaks of shields and armor used by the Indians in warfare which were woven so

WEAVING BASKETS BY MACHINERY



For thousands of years mankind has been making baskets by hand, sticking the upright spokes into a frame and weaving cross-strips through them, but recently the machine here shown has been perfected. As the machine revolves the wicker is drawn from the spools on each side and into the shuttles.

firmly that no arrow could pierce them. Basket boats were used by the Indians, as they were by the early Britons, and as they are to this day on the Tigris and Euphrates rivers (*see* Boats).

It was the woman of the household who made the baskets. She was the burden-bearer, and she early learned to weave vessels that were light yet strong and durable for carrying clay from the quarry, water from the spring, stones for grinding meal, firewood, fruits, seeds, roots, fish, flesh, and fowl to supply the household needs.

But she did not stop with this. Savage and uncultured as she was, the Indian squaw had a sense of beauty, and this she expressed in her baskets. She learned to extract dyes from roots and berries to color them. She made ornaments of shells and stones to decorate them. She stole the feathers of birds—the red of the woodpecker's crest, the orange of the oriole, the green of the mallard duck—to make more gorgeous the precious gift-baskets known as "jewels."

Most beautiful of all were the designs wrought into the baskets. Look at a collection of Indian baskets, and you will see how many of these designs represent objects in nature—the rainbow, the flowing water, the zigzag lightning, mountains, trees, flowers, birds, and animals. You will see, too, strange symbols, which if you could read them would tell of witchcraft and magic, legends of gods and heavenly beings. Into her baskets the weaver put her feelings, her dreams, and her prayers, the traditions and ideals of her race.

How You Can Make a Simple Basket

Boys and girls through patience and practice can learn to make beautiful baskets with simple materials and a very few tools. Those who live in the country can utilize some of the native materials used by the Indians—peeled twigs of the willow, or osier, split cat-tail leaves, flags and rushes, the tougher grasses, etc. Those who live in the city or who do not wish to take the trouble of preparing the native plants may use prepared materials, such as rattan and raffia.

Rattan is a vine-like palm which grows in the forests of India, twining about trees and hanging from the branches and sometimes reaching a length of several hundred feet. Before it comes to us it is stripped of leaves and bark and split into round or flat strips of various sizes, often called reeds. Raffia is a fiber obtained from the gigantic leaves of a palm that grows on the island of Madagascar. It comes to us in long strips that are very tough and pliable. In basket-making it is sometimes used alone, but more often in connection with rattan.

Here are directions for making a simple rattan basket. A heavier rattan should always be used for the spokes or ribs of the basket than for the weaving cane. The only tools needed are a pair of strong sharp shears, a ruler for measuring, and a deep pail for water.

Cut from the heavy rattan four 14-inch spokes and one 8-inch spoke. Have ready one of the finer reeds, to be used as the weaving cane, which you have previously soaked for an hour in cold water or fifteen minutes in hot. Arrange and cross the spokes as shown in Fig. 1, inserting the 8-inch

or half spoke between the halves of one pair of spokes.

Hold the spokes in position by the left hand, and taking the weaving cane in the right hand bind it firmly about them as shown in the diagram, going twice around. Then separate the spokes so that they radiate at equal distances in all directions, as shown in Fig. 2. Now begin the weaving—that is, pass the weaving cane over one and under the next spoke, going from left to right. The spokes should be very evenly separated and the weaving cane pressed down firmly with the

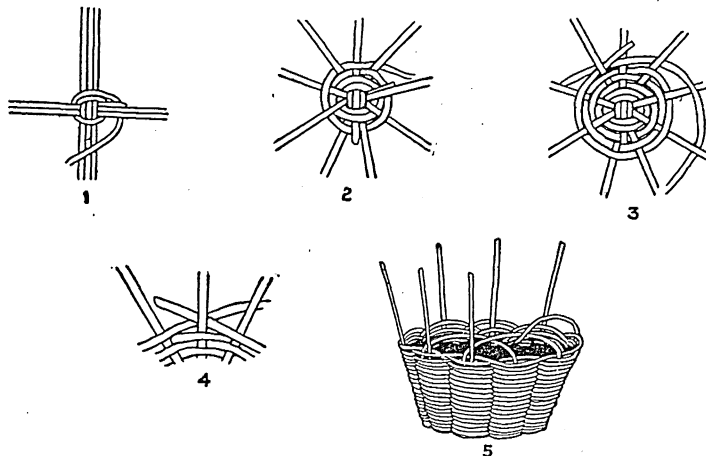
forefinger as it is brought around. Upon the care with which you do this will depend the strength and beauty of your basket.

When you have a mat or base several inches in diameter, wet the spokes and bend them sharply upward to make the sides of the basket. If the basket is to have straight sides the spokes should be bent at right angles; if sloping sides, at an oblique angle. In weaving the sides care should be taken to press each row close to the one before it. Two or more weaving canes will be needed to complete this basket. When the first weaving cane runs out, leave about half an inch behind a spoke and cross this with an equal length of the new weaving cane, as in Fig. 3.

To finish the edge of the basket, cut the spokes to an even length of about three inches beyond the weaving and trim each to a point. Hold the ends in water for a few minutes to make them pliable. Now turn back each spoke the opposite way from which you have been weaving and insert the point beyond the next spoke. Bend downward at least an inch below the edge of the weaving so that it will remain firmly in place, and press the top level with the last line of weaving.

BASKETBALL. Like lacrosse and hockey, basketball is an exceedingly fast game. It requires speed, ability to dodge with extreme quickness, and a keen eye for the goal. It was invented in 1891 at the training school of the Young Men's Christian Association in Springfield, Mass., by James Naismith, in response to a demand for a game that could be played indoors in winter to take the place of baseball and football. With surprising rapidity it spread to schools, colleges, and athletic clubs all over the United States, and after a time made its way across the Atlantic to the British Isles.

THE FIVE STEPS IN MAKING A BASKET



Whether you live in the country or in town—for there is plenty of material to be had in both places—boys and girls can get a great deal of pleasure as well as training in skill of hand from making baskets. These pictures show the five steps in the process, as explained in the text.

A BASKETBALL CHAMPIONSHIP GAME IN FRANCE



This picture has special interest both from the standpoint of outdoor sport and history. It shows one of the championship games played by American troops in France in July 1919. The man in the center has just made a free try for goal. If the ball enters the basket, his side scores a goal.

The game is played on a court either indoors or outdoors. The ideal dimensions of the court are 50 by 94 feet for colleges and 42 by 74 feet for junior high schools. At each end of the court there is a goal or basket 10 feet above the floor. It consists of a black metal ring, 18 inches in diameter, with a net of white cord suspended from its rim. A round leather-cased ball is used, from 29 to 30 inches in circumference, weighing from 20 to 22 ounces.

Here We Get into the Game

There are five players on a team—a center, two forwards, and two guards. At the start of the game the referee goes to the middle of the court and tosses up the ball between the opposing centers. The other players must stay outside the six-foot circle until a center taps the ball (the center jump). Each team then tries to throw the ball into its own basket. The ball may be batted with the hands, passed, bounced, rolled, or thrown in any direction; but carrying, kicking, or punching it is a violation which is penalized by awarding the ball to an opponent out of bounds. No player may hold, trip, charge, push, or block an opponent. The one against whom such a foul has been made is entitled to one or two free throws. If the free throw misses, the ball

continues in play. A goal made from the field counts two points; from a free throw, one point. After a goal is scored the ball is put back into play from out of bounds. If any player sends the ball outside the boundaries of the court, either by throwing it or by batting it with his hands, the referee blows his whistle and gives the ball to a member of the opposing team who then endeavors to throw it into the court to one of his teammates. To prevent "stalling" in an attempt to slow up the game, the team that has the ball in its own back court must return it over the center line within 10 seconds.

In the early years of the game, when each team aimed at its opponent's goal, the guards' work was usually limited to protection of their own goal. The two forwards carried the offensive. The center, the "rover" of the team, aided guards and forwards whenever it seemed necessary.

Teamwork Is the Thing

Now, however, as the best teams play the game, there is very little difference between the duties of guards, forwards, and centers. The team plays as a unit, taking the offensive when necessary, and whenever possible forcing the play into the territory of its own basket. It is not uncommon for the guards of a good team to score more points than the forwards. Team play, as in so many other sports, is the vital element. The team that guards, passes, and shoots together usually wins.

The rule that no player may carry the ball forward or backward makes basketball very largely a passing game. The ball moves back and forth from one player to another very rapidly, and all five members of the team are constantly on the move, seeking to elude their opponents. Although it is forbidden to carry the ball, a player may "dribble"—that is, bounce the ball back and forth between either hand and the floor

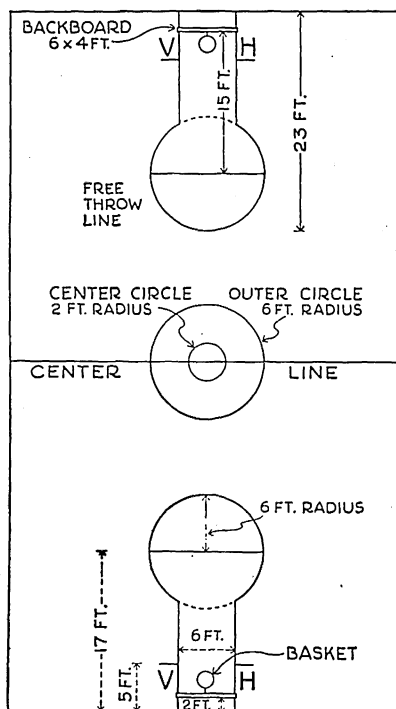


Diagram of regulation court. The maximum size permitted is 50 by 94 feet; minimum, 42 by 74 feet. "V" shows position of visiting team during free throws, "H" position of home team.

PICTURE POINTERS ON HOW TO PLAY BASKETBALL

THE JUMP

CROUCH



TIME
SPRING
TO
TAP
BALL
AT
TOP
OF
LEAP



THE DRIBBLE

BOUNCE
BALL
WAIST
HIGH



FINGERS
SPREAD

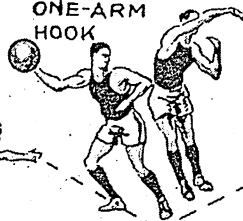


DIRECTLY
IN FRONT OF
BODY



THE PASSES

OVERHEAD
ONE-ARM
HOOK



SHOULDER



UNDERHAND



CHEST



BOUNCE



BASKET SHOTS

CROSS BODY



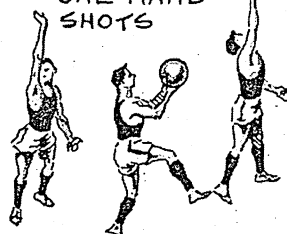
UNDERHAND
LOOP



TWO-HAND
CHEST

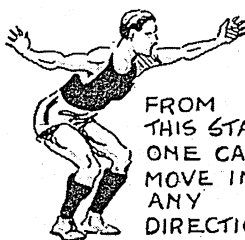


CLOSE UP
ONE-HAND
SHOTS

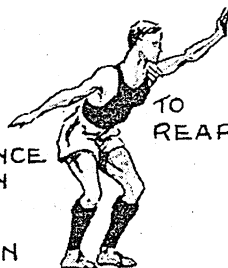


GUARDING

FROM
THIS STANCE
ONE CAN
MOVE IN
ANY
DIRECTION



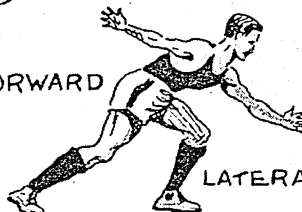
TO REAR



FORWARD



LATERALLY



FOULS

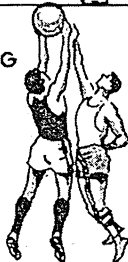
RUNNING
WITH
BALL



A STEP
OVER
FOUL
LINE
ON
PENALTY
SHOT



CATCHING
JUMP
BALL



STRIKING
OPPONENT
INSTEAD OF
BALL



ROUGHING
OPPONENT



Study the crouch and spring shown in the first picture, for the center who bats the ball into the enemy's territory when the referee puts it in play gives his team an advantage. Dribbling is a valuable asset in advancing the ball, and the next pictures show the proper way to dribble. The five best methods of passing the ball are shown in the second strip. Just below we find various excellent methods of "shooting" for the basket. The best stance for guarding, that all-important defensive move, is illustrated next. Finally we come to a series of "don'ts." Study the fouls pictured and avoid them, for fouls cost many a game.

so that it keeps pace with him as he dashes toward his goal. When he is within "shooting" distance, he seizes the ball and tries for the basket. An expert dribbler can score with one-hand shots while running at full speed.

Why Players Should Avoid Roughness

Rules against rough play must be strictly enforced to prevent serious injuries. Major infractions of the rules are termed *fouls*. The chief officials—the referee and the umpire—call the fouls and penalize offenders by awarding free throws to their opponents. Holding, tripping, charging, or any other form of unnecessary roughness is considered a *personal foul*. A player guilty of four personal fouls must leave the game. *Technical fouls* are called against players for delaying the game or using unsportsmanlike tactics such as obstructing the vision of an opponent or talking discourteously to officials.

Length and Number of Periods

The length of the game is regulated in accord with the age and stamina of the players. College teams play for two periods of 20 minutes each, with a 15-minute rest between halves. If the score is tied at the end of the second half, play continues for as many five-minute periods as are needed to break the tie.

High school teams play four quarters of eight minutes each, with a 10-minute rest between the second and third quarters. If the score is tied at the end of the fourth quarter, an extra period of three minutes is played. Should this fail to break the tie, the game continues until one team scores two points or until one team leads by one point at the end of any three-minute extra period. Boys 14 years old and under play four six-minute quarters, with a rest of 10 minutes between the second and third quarters.

Some Features of Women's Basketball

In official basketball for women the team has six members—three forwards and three guards. Only the forwards are allowed to throw for the basket. Players do not range the entire court as in men's basketball, but each must stay in her own section. An official court measures 90 by 45 feet, and it is divided into either two or three sections parallel to the end lines. The game is divided into four quarters of not more than eight minutes each, with a 10-minute rest between the second and third quarters.

The Most Popular Sport in the United States

Basketball, not baseball or football, is the sport which attracts the greatest number of paying spectators. It draws as many as 90 million paid admissions a year. This is because so many teams play the game. Indiana alone has more than 900 high school and college teams besides church, town, and club teams.

Crowds are especially large at the tournaments held in most of the states to pick the state high school champions. A crowning event of the season is the National Collegiate Athletic Association tournament to decide the national college champion. Professional basketball employs many ex-college stars, but it does not draw the crowds that amateur basketball does.

BASKET-MAKERS. Three or four thousand years ago, long before the Cliff Dwellers built their stone houses in the walls of great canyons for protection from their enemies, a roving people settled in caves in what is now Utah, Colorado, Arizona, New Mexico, and Nevada. We don't know the name of these people, but because of the many fine baskets found in their stone-lined grave pits, we call them the Basket-Makers.

These people gathered wild seeds and fruits, hunted small game, and cultivated corn, beans, and other foods, which they stored for winter use in pits dug in or near their caves. The pits were lined with slabs of stone and plastered with mud. When the Basket-Makers began to erect rude dwellings to take the place of their caves, they buried the dead with their belongings in those pits, a custom to which we owe a rich store of well-preserved relics.

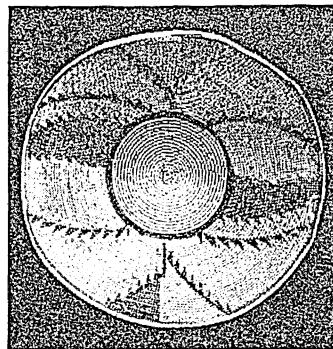
The men at first used curved clubs, spears, and throwing darts, called by the Aztec name *atlats*. Later, they learned to make bows and arrows. The men wore little clothing in summer, but protected their feet with grass sandals and wore fur-cloth robes in winter. The women wore short apron-like cord skirts, and sandals. They wove fur-cloth and feather-cloth. Their baskets and bags were decorated with attractive designs. Some of the conical willow

baskets were three or four feet wide.

About the time the Basket-Makers began to gather into villages, the women experimented with the first pottery made on this continent, by building up clay in basket bottoms and drying it in the sun. Later they learned to fire the pots, and in time added decorations.

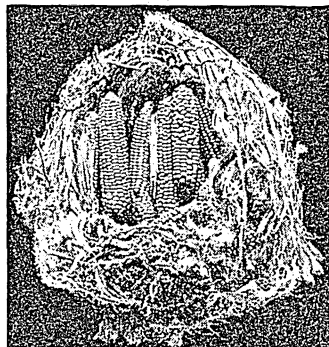
Skeletons and mummies of Basket-Makers show they had long heads, and did not deform the skulls of their children, as did the Cliff Dwellers. What became of this ancient tribe is still a mystery; some think they were absorbed by the Pueblos (see Pueblo Indians).

AN ANCIENT ART



A specimen of the Basket-Makers' craft is the conical basket pictured above and now in the American Museum of Natural History. It has the sun-and-mountain design.

STORED 3,000 YEARS

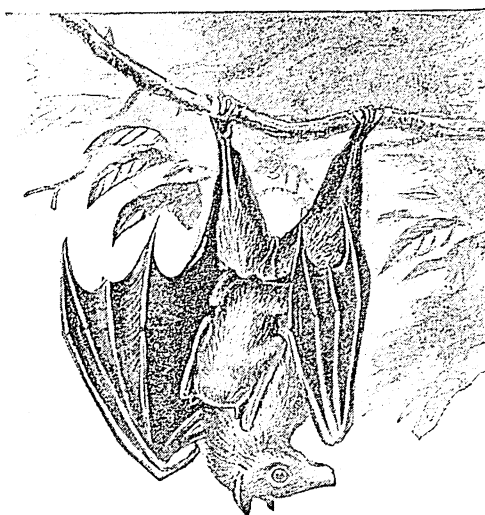


The above cache, used to preserve corn and other stores, was found in a cave in Cave Lake Canyon, Utah. It is now in the Museum of the American Indian, New York City.

BASS. Various perchlike species of fresh-water and salt-water fishes, differing in size, shape, and color, are called bass; but on the angler's hook all are vigorous fighters, and on the table all are prized as food. The small-mouthed and large-mouthed black bass are two distinctively American species, inhabiting lakes and streams. The latter is the larger, attaining a weight of 15 to 20 pounds. They delight the sportsman with their fighting qualities and astonish the naturalist with their nest-building habits and care in guarding the eggs. The black basses and their relatives of lesser value, the common rock bass and the calico bass, belong to the sunfish family (*Centrarchidae*).

Belonging to the family *Moronidae* are the white bass found in the vicinity of the Great Lakes, the yellow bass of the lower Mississippi, and the striped bass of the Atlantic coast of North America. The sea bass family (*Serranidae*) is represented by numerous gamy food fishes which inhabit shoal waters, mostly in northern regions. The name bass was first applied to an European member of this family. (See Fish.)

BAT. Did any boy ever have a stranger pet than Charles Derennes, with his tame bat? This observant Frenchman has written an enchanting book called 'The Life of the Bat', in which he tells the story of Noctu, a bat which he taught to eat from his hand and take pleasure in his fondling. To him the bat is one of Nature's most wonderful creatures, and



This is a Collared Fruit Bat carrying her baby, which clings to her fur, hanging upside down just as its mother does.

he insists that his pet Noctu had "the most human expressions that I have ever seen in the face of an animal."

You may wonder how anyone could like a bat. He's certainly not handsome, nor does he look very intelligent as he hangs upside-down from a twig, blinking his beady little eyes in the daylight. But wait; you'll admire him more when you learn to know him better.

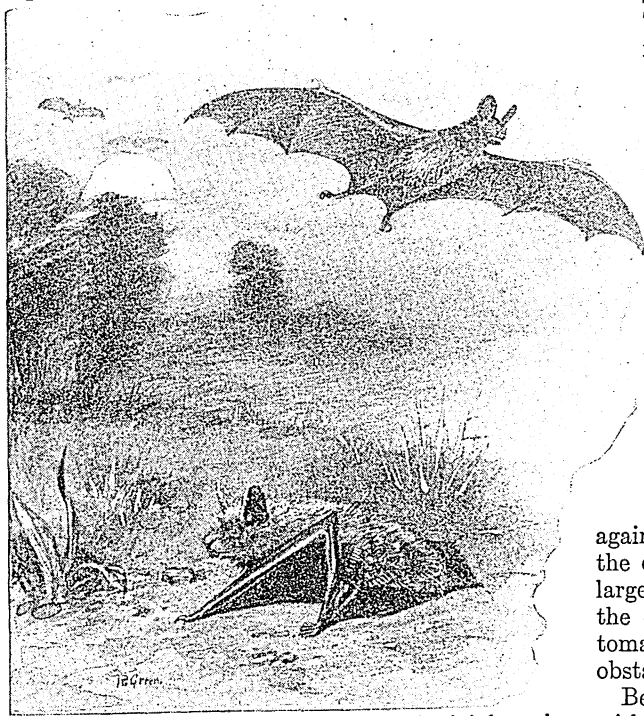
Do you see those strange wings of thin dark skin which the bat wraps around him like a cloak? These are perhaps the most delicate sense organs in the world. Take the bat in your hand. He won't hurt you if you're gentle and avoid that frightened snarling mouth. You'll feel the small creature trembling all over. That's because, to those sensitive wings, the touch of your palm is like a rasping file.

Wings that "See" in the Dark

Those wings and his big vibrating ears are the mystery and wonder of the bat. They enable him to fly in the darkest night, through the thickest forest, when his eyes are of little use to him, and pursue his insect prey without striking a single trunk or branch. They are made up of a close network of fine nerves which seem to be able to detect in advance the slightest vibration in the atmosphere, caused by the friction of air currents against solid objects. Experimenters have sealed up the eyes of bats with gum, and released them in a large room where many ropes were suspended from the ceiling. The bats flitted about with their customary bullet speed, without striking one of the obstacles.

Because bats have wings they used to be classed with birds. But they are, of course, mammals, because they bring forth their two or three young alive and suckle them. The young bat is at first very tiny,

THE WINGED NIGHT-POLICEMEN ON THEIR ROUNDS



The Noctules, or Great Bats—you can tell them by their large size and broad rounded ears—are among the first to go on duty chasing insects on summer evenings. Like other bats, the Noctule is no hand for walking, but when it does walk it takes the queer position shown.

naked, and pink, but it clings vigorously to its mother's breast as she darts through the air. When at rest, the mother bat folds her delicate wings around her young to keep them warm.

Bats usually spend the day in caves, hollow trees, thick bushes, church towers, or old barns and deserted



A close relative to the Noctule Bat is the Hairy-armed Bat here shown. It gets its name from a broad band of fine short hairs under the wing, running from the forearm to the wrist.

buildings. They do not alight on the ground if they can avoid it, for they crawl with great difficulty, and they cannot spring into the air from a flat surface, but must climb up a little distance in order to launch themselves on their flight.

The Little Policeman with Leathery Wings

There are altogether about 300 kinds of bats, distributed all over the world, except in the very coldest regions. As a rule they are small, but the flying-foxes of the Malay region have a spread of wings sometimes measuring five feet. These and other large bats found in the tropics are fruit-eaters and do much damage to crops; but the northern bats feed on insects, and so are very valuable to man. Indeed, the bat may be looked upon as the night policeman of our crops and gardens, for it devours enormous quantities of harmful moths and flying beetles. In certain parts of the South they are so valued, both for the good they do in destroying harmful insects and for the guano they produce, that huge roosts or shelters have been built for them.

The voice of the bat is pitched so high that most persons cannot hear it at all. Those whose ears are sensitive enough to perceive such high tones report that the bat's cry varies from a soft chirp to a piercing squeal.

Vampire Bats in Fact and Legend

Silly tales are told about bats, such as the one that they get tangled in women's hair. There are,

however, certain tropical *vampire* bats which settle on the backs of horses and cows or even on sleeping human beings and puncture the flesh, lapping up the blood as it flows out. Sometimes their victims are so weakened that they die. These greatly dreaded little creatures have such small gullets that nothing but liquid food can pass through. They are common in parts of Central and South America, but are never found in the United States. These blood-drinking bats get their name of vampire from the "vampires" of legend—ghosts which come out of their graves at night, according to an ancient and widespread superstition, and suck the blood of human beings.

The name of the order of bats is *Chiroptera*, from the Greek words meaning "hand-winged." If you look closely at a bat's wing, you will see that the bones correspond roughly to the fingers of your hand, the hook at the top representing the thumb. The species most frequently seen in the northern United States are the little brown bat (*Vespertilio subulatus*), and the red bat (*Lasiurus borealis*). Scientific name of common vampire, *Desmodus rufus*.

BAVA'RIA, GERMANY. The traveler who approaches this state of southern Germany from the north is struck by many contrasts. Bavaria is a region of green-clad mountains and fertile valleys, and its dark-haired people differ in many ways from their light-haired Prussian neighbors on the north. In general, they are more easy-going and tolerant, and they are more ardently devoted to music and color. Their country is the true home of German art.

Careless of the rush of modern factory industry,

A BAVARIAN FOLK DANCE



A traveler in Bavaria took this snapshot of one of the most popular of the Bavarian folk dances. It is somewhat like the Virginia reel, except that it is danced by one man and two women instead of two couples. They dance separately at first, the man and the women alternately advancing toward one another and retreating. Later in the dance the women circle around the man several times, as they are doing in the picture.

the Bavarian countrysides have kept something of the warm picturesqueness of the Middle Ages. The peasants in the more remote valleys still wear quaint costumes, rich with embroidery and silver buttons. The herd-girls, in their dark full skirts and scarlet

bodices with white sleeves, may still be seen guarding their flocks on the distant hills as their forebears did four and five centuries ago. Even in the towns descendants of the famous gild craftsmen of former days still labor in their little shops, turning out the skilled handwork in wood and metals for which medieval Germany was celebrated the world over.

Cut off by wooded mountains to the northeast and northwest, and by the towering snow peaks of the Alps to the south, Bavaria has until the past century run a separate course in spirit and politics from the rest of Germany. When their northern neighbors followed Luther in the Protestant Reformation, the Bavarians remained Roman Catholic. When Napoleon overran Europe, Bavaria sided with the French. When Prussia and Austria fought in 1866, she helped Austria. Even after the formation of the German Empire in 1871, Bavaria kept her own army and postal system, her own laws and customs, and her own royal family, which continued to rule until the revolution of 1918.

From the days of the Roman Empire, whose boundaries followed the rivers Danube and Main squarely through the middle of Bavaria, the Bavarians have been intimately associated with Italian civilization. A rich commerce flowed northward over the Alpine passes to the ancient cities of Augsburg, Regensburg (Ratisbon), and Nuremberg. Bavaria thus early became a center of wealth and learning. Out of these intimate associations, in which Bavaria formed the link between the Latins to the south and west and the Teutons and Slavs to the north and east, grew the cordial adaptable spirit found in present-day Bavaria.

Today the pack mules, laden with the rich silks, tapestries, and spices of the East, which wound their way through the passes of the Alps, are replaced by iron rails and locomotives. But old Nuremberg is still the commercial and industrial center of south Germany. Munich, the capital of the state, as well as the literary and art center of Bavaria, presents a thoroughly modern appearance with its broad streets and beautiful buildings (see Munich; Nuremberg).

Generous crops grow on Bavaria's rich acres—grain, potatoes, grapes for wine, and hops for beer making, the ruling industry. Other industries of Bavaria range from the creation of ingenious toys to the making of porcelain from its clays, the manufacture of chemicals from its salt and other mineral deposits, and the smelting and casting of its iron, with coal from its mines and those of the Saar basin near by. In the Alpine foreland, with its picturesque shingled cottages, stock raising prevails; while most of the crops are grown in the fertile Danube basin.

Amid the mountains of southern Bavaria lies the little village of Oberammergau, where every ten years the villagers produce the Passion Play of Christ's crucifixion. The peasants play all the 350 parts—Jesus, Mary, Pilate, Caiaphas, the Apostles—and the preparations are long and earnest. The drama takes

all day with a noon intermission, and is played some 30 times, to crowds from all over the world.

Bavaria was organized as a duchy before the days of Charlemagne. Napoleon in 1805 conferred the title of king on the head of the ancient ruling house. After the World War the kingdom became a republic known as the free state of Bavaria (*Freistaat Bayern*). In 1933 the constitution was set aside and the state placed under the absolute rule of a governor. Bavaria is third in area and second in population among the states of Germany. Area, 29,334 square miles; population, about 8,280,000.

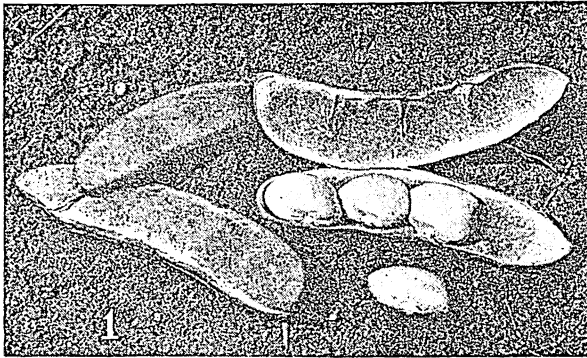
BEAN. One of our most nourishing vegetable foods is the bean. Its carbohydrate content is high, and so rich in protein are some varieties—particularly the navy bean—that they provide a very good and inexpensive substitute for lean meat. The bean plant belongs to the group of leguminous plants whose roots gather the little nitrogen-fixing bacteria that are so valuable in fertilizing the soil (see Nitrogen). It is an excellent food for animals.

There are many varieties of beans, all of which have certain characteristics in common. They are all annuals, grown from seed, and every variety has clusters of butterfly-shaped flowers which are followed by pods containing the seeds, or beans. In different varieties the flowers and beans vary greatly in size and color and the beans vary in shape. The pods are usually from two to eight inches long.

Beans of different kinds are an important food throughout the world. The pods of some varieties are eaten; others, such as the limas, have inedible pods. The most widely used bean in the United States is the dried navy bean, from which the famous Boston baked beans are made. It is a kidney bean, as are the green and wax string beans and the red kidney beans, which are also popular on American tables. The kidney beans are thought to have originated in South America. The lima bean, which is eaten either green or dried, is another favorite; it comes from Peru. Tepary beans and the small flat black frijoles (*frē-hō'lā*) are widely cultivated in Mexico and other Latin-American countries, where they are a staple food. They are also grown in the southwestern United States. The cowpea, which, in spite of its name, is a bean, is the chief forage and manuring crop in the southern United States. The shelled seeds of some varieties of cowpea, such as the black-eye bean, are eaten green or dried (see Cowpea). Another important kind is the soy bean (see Soy Bean).

Michigan produces about 40 per cent of the beans grown in the United States and about 90 per cent of the navy beans. California grows 28 per cent, and leads as a producer of lima beans. New York, Colorado, Idaho, New Mexico, Montana, and Wyoming produce most of the remainder of the bean crop. Eighty-five per cent of the country's exports are shipped to Canada and the Latin-American countries. The average annual consumption of dried beans in the United States is nearly nine pounds a person.

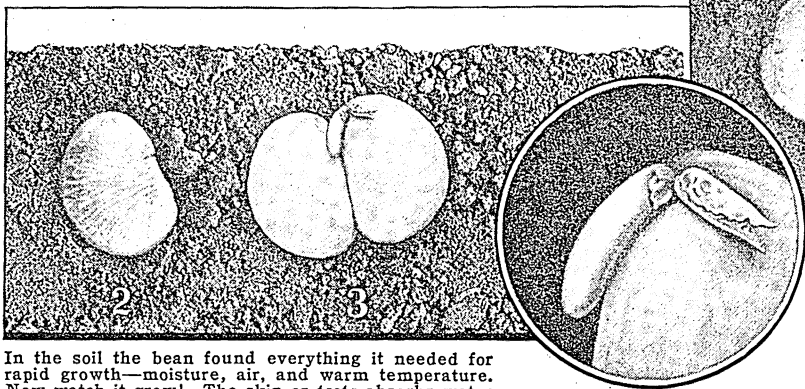
WATCH THE BEAN PLANT GROW!



Picture 1 shows some beans in a pod all ready to be eaten or planted. The bean which has dropped from the pod was planted according to the directions given at the right. It was then photographed through the glass, to make this series of pictures.

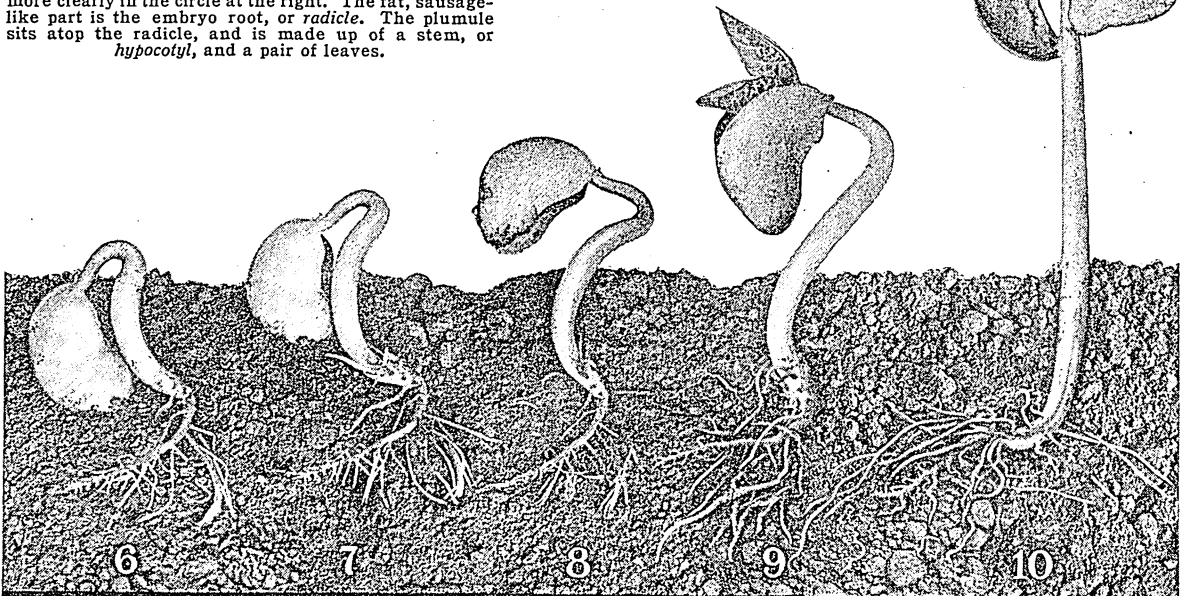
The pictures on this page were made by photographing the bean plant from time to time as the seed, or bean, began to grow. They show the plant pushing its way through the soil to the surface and extending its roots deeper into the earth. Watching a bean plant grow from the time the seed is planted is an interesting experiment as well as a very simple one to carry on at home.

Remove one side of a small wooden box and substitute a glass pane in its place. Fill the box with earth and plant a bean against the glass about an inch below the surface. Keep the glass covered with a piece of cardboard or heavy wrapping paper so that the seed will not be exposed to the light. You may, of course, remove the covering when you are observing the plant. The box may be kept in a dark place until the plant reaches the surface of the soil, but after that the growing plant should have some sunlight.



The radicle starts growing first and presently breaks through the *hilum*, or scar of attachment on the seed coat.

In the soil the bean found everything it needed for rapid growth—moisture, air, and warm temperature. Now watch it grow! The skin or *testa* absorbs water quickly and is wrinkling (Picture 2). Did you ever see the inside of a bean? One has been opened in Picture 3. The two fleshy disks are the seed leaves, or *cotyledons*. Fastened to the top is the embryo plant, shown more clearly in the circle at the right. The fat, sausage-like part is the embryo root, or *radicle*. The plumule sits atop the radicle, and is made up of a stem, or *hypocotyl*, and a pair of leaves.



The radicle now lengthens out to form the primary root, which soon branches to form many secondary roots. Meanwhile the embryo stem, or hypocotyl, begins to grow rapidly and arches its back above the soil (Pictures 6 and 7). This arch, anchored by the numerous roots, forms a powerful lever which pulls the pair of yellow-green leaves from the earth in response to sunlight. The seed leaves have furnished all the food for the plant thus far. Now they wither and fall off, leaving the production of food to the new foliage leaves.

The common bean of Europe is the broad bean, which has been used as food since the remotest times. Our scarlet runner is an ornamental climber, which in Europe is also grown as a string and shell bean.

Beans are prepared for winter use in various ways. Enormous quantities are ripened, shelled, and dried.

Dried beans are also cooked, seasoned ready for the table, and canned as baked beans. String beans are also canned.

Beans are legumes of the family *Fabaceae*. Scientific name of the kidney bean, *Phaseolus vulgaris*; of lima bean, *Phaseolus lunatus*.

The VERSATILE Members of the BEAR FAMILY



The American Black Bear is a good climber and acrobat in spite of his size.

BEAR. The bear family includes the largest of all flesh-eating land animals. Lions rarely weigh as much as 500 pounds and the biggest tigers stop short of 600 pounds, but the polar bear and the grizzly may weigh as much as 900 or 1,000 pounds. The great Alaskan brown bear has been known to scale 1,500 or 1,600 pounds. At the other extreme, the two smallest members of the family—the Malay sun bear and the spectacled bear of the Andes—weigh less than 100 pounds.

In character and habits bears show as much variation as they do in size. Some, like the grizzly, the polar bear, and their tiny cousin the sun bear, are likely to be short-tempered and savage. But most of the others are peaceful, easy-going animals. The polar bear is one of the best swimmers among land animals; the common black bear and most of his smaller relatives are skilful tree climbers.

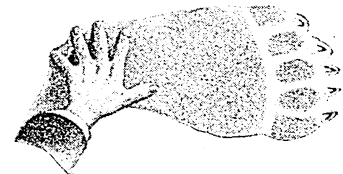
Bears are also remarkably adaptable to varied conditions of life. Members of the family are found in mountains and lowlands and in every climate from the tropics to the Arctic. Almost all bears can adjust them-

selves easily to life in captivity. Their adaptability is particularly marked in their feeding habits. Though they are classed as flesh-eaters, their teeth are suitable for either tearing flesh or grinding vegetable food; and their diet is likely to include grass, grain, roots, nuts, fruit, grubs, insects, snails, crabs, frogs, snakes, eggs, fish—almost anything, in fact, that is eaten by any animal. Most bears are especially fond of ants and of honey.

Bears seem clumsy creatures. This is due to their peculiar gait. In the first place, bears are “plantigrade” or flat-footed; the heel of the foot rests on the ground like a man’s (see Foot). In the second place, they move both legs on one side of the body forward at the same time. This gives them a rolling motion. Yet they can be swift and nimble in action, galloping fast enough to overtake any human runner; and they can stand on their hind legs and strike out like a cat with their powerful front paws.

Their awkward appearance and their usual slow, deliberate movements have led to the common belief that bears are stupid. Old fables and folk-tales often represent the bear as the victim of practical jokes played by the other animals. Zoo keepers, however, agree that bears are among the most shrewd and intelligent animals that they have to deal with. Many stories are told of their patient ingenuity in getting out of cages.

Most wild bears hibernate from two to six months even in warm climates where food is plentiful the year around; but in captivity they rarely do so. The winter quarters may be a cave, the base of a hollow tree, or a den that the bear scoops out for itself. Sometimes it covers itself with leaves and grass, leaving only a small air hole (see Hibernation). In the winter den the young are born, from one to four at a time. The cubs are almost hairless and extremely small and helpless at birth. They remain with the mother for more than a year.



The Bear leaves a footprint much like a man's. The claw marks tell you that he cannot draw in his claws as a cat does.

Different kinds of bears are widely distributed throughout North America, Europe, and Asia, and some parts of northern Africa. Only one species is found in South America, and none in Australia.

The bears of North America constitute four distinct and easily recognized groups. Their common and scientific names are: Black bear (*Ursus americanus*); Grizzly bear (*Ursus horribilis*); Alaskan brown bear (*Ursus gyas*); Polar bear (*Thalassarcos maritimus*).

The black bear was originally found in all parts of the North American continent, except in the extreme north, and it still exists wherever there is extensive forest land sufficient to shelter it. Though persistently hunted for several hundred years, it is still found in the Adirondacks and in New England. In the fall when the coat of this bear is at its best, the fur is entirely black except for a brown patch on the muzzle and an occasional white spot on the breast. Its hearing and sense of smell are very keen and enable it to avoid its enemies. The least suspicious sound or odor is sufficient to start it from its lair, and it requires a skilful hunter to run it down or approach within rifle range. A large black bear may weigh 500 pounds or more, but the normal weight is much less.

The cinnamon bear is a color variation of the black bear, both types being found in the same litter. For a long time after its discovery the cinnamon bear was believed to be a distinct species, and most of the early accounts described it as being equal to the grizzly in size and exceeding it in ferocity. But science dissipates all illusions and superstitions; and since the true position of the cinnamon bear has been established, it is regarded as the shy inoffensive animal that it really is.

Five other forms or sub-species of the black bear are now recognized, four of which closely resemble the main type. They are found respectively in Florida, Louisiana, Labrador, and Queen Charlotte Island.

The fifth, known as the glacier bear, is of a rare bluish-gray and is found in Alaska, in the vicinity of Mt. St. Elias. Like the cinnamon bear, the glacier

bear was formerly thought to be a distinct species, but a litter of young ones, in which both types were represented, established the true relationship.

The black bear is often seen in captivity and is a favorite with young and old. Its habit of standing erect, its droll appearance, and its plaintive appeals for dainties, which are generally accompanied by a whine like that of a child, give it a human aspect. This is further heightened by the amusing antics of the cubs, which may be likened only to the romping and wrestling of boys. Bears have a keen sense of humor, as evidenced by their fondness for ducking one another in a pool. Dr. Hornaday says bears are easily kept in captivity, and if properly

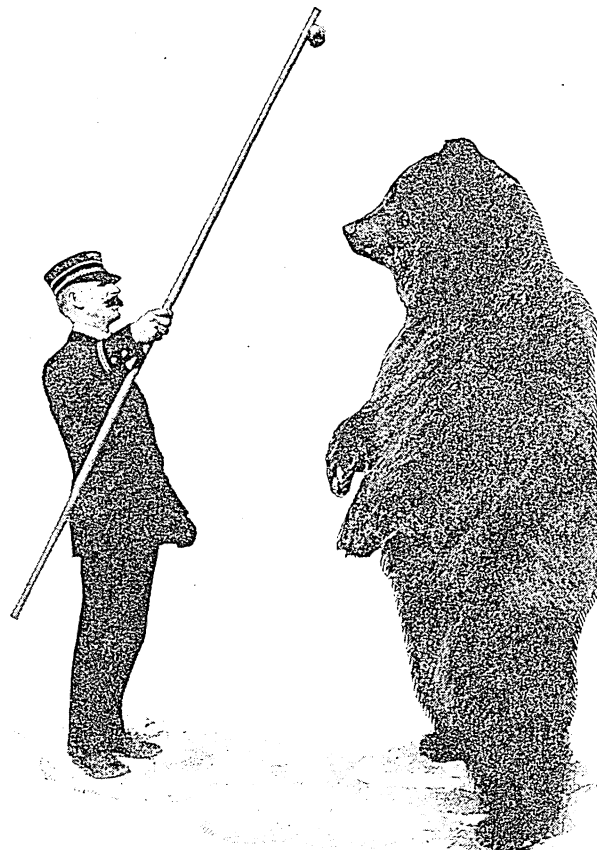
fed and not too closely confined they are good-natured and contented.

America's Fiercest Animal

The grizzly bear, or "silver-tip," inhabits the western part of North America from the Arctic Ocean to southern Mexico, and from the Rocky Mountains to the Pacific. There are several varieties. In size some about equal that of the black bear, but the largest attain a length of ten feet and a weight of about half a ton, and are capable of carrying off small horses and cattle. They vary in color from a light yellow to almost black. The tips of the hairs are lighter, giving them a grizzled appearance, whence come the names grizzly and silver-tip.

The grizzly is the fiercest and most dangerous American mammal. The Indians feared it and the warrior who overcame a large one was very properly regarded as a great brave. The grizzly possesses greater intelligence than the black bear, and when wounded or brought to bay is a dangerous antagonist. The coming of the white man with firearms marked the beginning of the end, and like other big game the

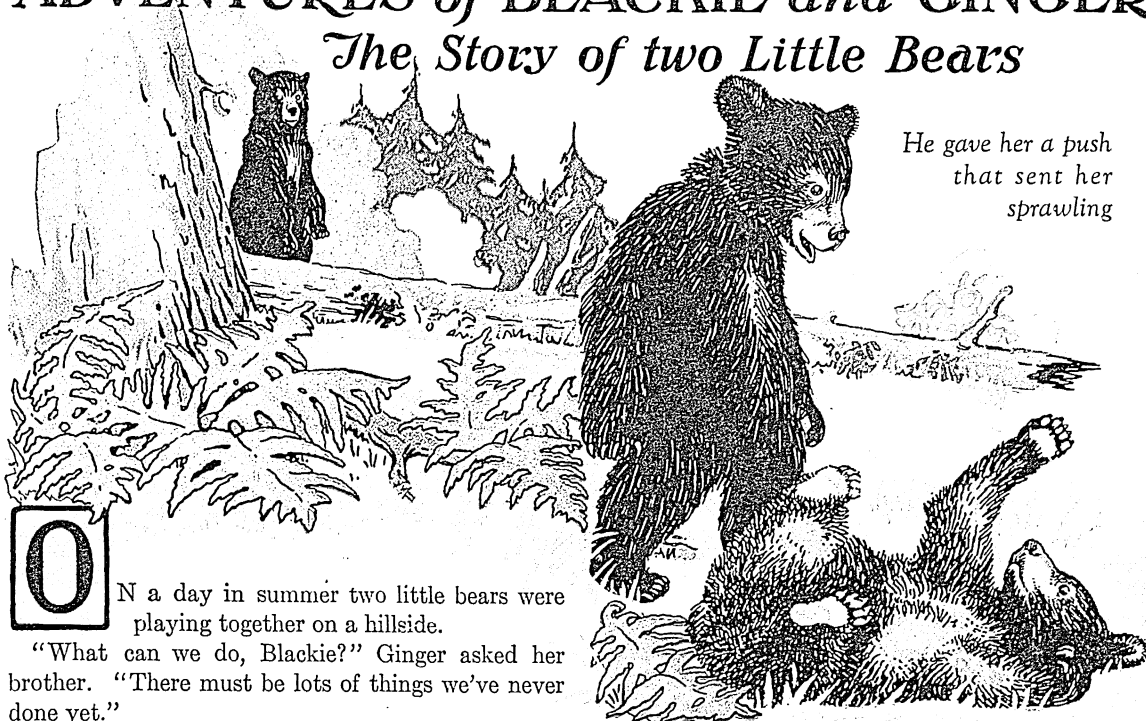
THIS ALWAYS AMUSES THE CHILDREN



One of the keepers is asking one of the Black bears in that wonderful collection of animal life, the New York Zoo, to stand on his hind legs for the amusement of the children.

ADVENTURES of BLACKIE and GINGER

The Story of two Little Bears



He gave her a push
that sent her
sprawling

ON a day in summer two little bears were playing together on a hillside.

"What can we do, Blackie?" Ginger asked her brother. "There must be lots of things we've never done yet."

"I'll tell you," Blackie answered. "Let's hide in the bushes so that mother can't find us when she comes back."

"You know very well that mother will find us!" Ginger said. "She'll smell us right away."

"I can hide so mother won't find me," Blackie boasted. "I can hide so she couldn't ever find me!"

"You can not!" Ginger said quickly. "Mother can find anything anywhere just by smelling it."

Blackie did not answer. Going over to his sister he gave her a push that sent her sprawling on her little back. Ginger got to her feet and rushed at Blackie as hard as she could. She loved a rough-and-tumble just as much as he did.

Blackie saw her coming and was ready for her. Rising to his hind legs, he gave her a smack. This time Ginger did not fall; instead, she rose to her hind legs too and cuffed Blackie on the ear.

The two little bears were so busy scuffling that they did not see the mother bear coming toward them. Suddenly her big paw reached out and. . .

"Wooff!" said Blackie, sitting down on the ground very hard.

"Whuff!" said Ginger, landing near him.

"Stop it!" said the mother. "Listen to me! I have a treat for you. I know where there is something specially good to eat—something that you both like very much."

"What is it? What is it?" cried both little bears.

"It is honey!"

"Oh—Oh—Oh!" Blackie and Ginger stood on their hind legs and waved their paws joyfully. "Where is it, mother? Where is it? How did you find it?"

"I smelled it," she answered. "I think it is in an old tree on the other side of the hill. It won't take us long to get there. Come along! Single file!"

She started off, rolling her great body from side to side. The little bears followed, trying to walk just as she did. They lifted both feet on one side at the same time, first the right and then the left, then the right and then the left. And they put their feet down flat, just as she did, leaving tracks that showed the prints of their claws.

"Look, mother!" Ginger called out. "Blackie isn't coming! He's back there looking for grubs under a stone!"

Mother bear stopped and turned her head. "Blackie!" she called sharply, "come along! You can hunt for grubs any time, but you don't get honey every day."

"But I'm hungry now," Blackie said, turning over a large stone with his front paw, "and it's a long way to the honey tree."

The mother bear started back toward Blackie. He gulped down a large fat grub and came running toward her. "I'm coming, mother," he called. "I'm hurrying as fast as I can."

The bees
buzzed
and
swarmed
angrily



Then for a while the two little bears followed her without a word.

Presently Ginger whimpered. "It's hot and I'm tired. We've walked a long way, haven't we?"

"I'm not tired," Blackie said. "I can walk ever and ever so far and not get tired."

"I wish the honey tree wasn't so far away," Ginger complained. "I wish we were back in our nice den, with mother to feed us."

"Ho! I don't," Blackie said scornfully. "We're too old to drink milk now. And anyhow, I like grubs and fruit and berries better—and honey," he added. "I like honey better than anything."

"I do too, only I don't like to walk so far to get it. Do you remember how dark the den was, Blackie?"

"Of course I do. I remember all about it. We were born there, and for a good many days we didn't open our eyes."

"I like honey better than
anything," said
Blackie



"You don't remember that at all, Blackie Black Bear! Mother told you that—I heard her! And I heard her tell you that we didn't go out of the den until we were three months old! I don't believe you really remember anything about the den."

"I do too!" Blackie said crossly. "I remember that it was cold."

"That's because we didn't have nice thick fur then," Ginger said. "Mother told me that we didn't have much fur at all when we were born. We weren't very big either—we weren't much bigger than squirrels!"

"I was *never* as little as a squirrel!" Blackie said, very angry at the thought of this. "Was I, mother?" he called. "Was I ever as little as a squirrel?"

"Yes, you were," his mother said, "but you children had better hurry up. We are getting near the honey now. It's in that old hollow stump right over there."

The two little bears forgot everything else and ran to catch up.

"Um-m!" Blackie said, sniffing the air, "doesn't it smell good?"

"Yes," Ginger answered. "Only I hope the bees won't sting us the way they did last time."

The mother bear went straight to the stump. The bees buzzed and swarmed angrily, but she paid no attention. She began to scratch and tear at the rotting wood to make a hole big enough for her paw.

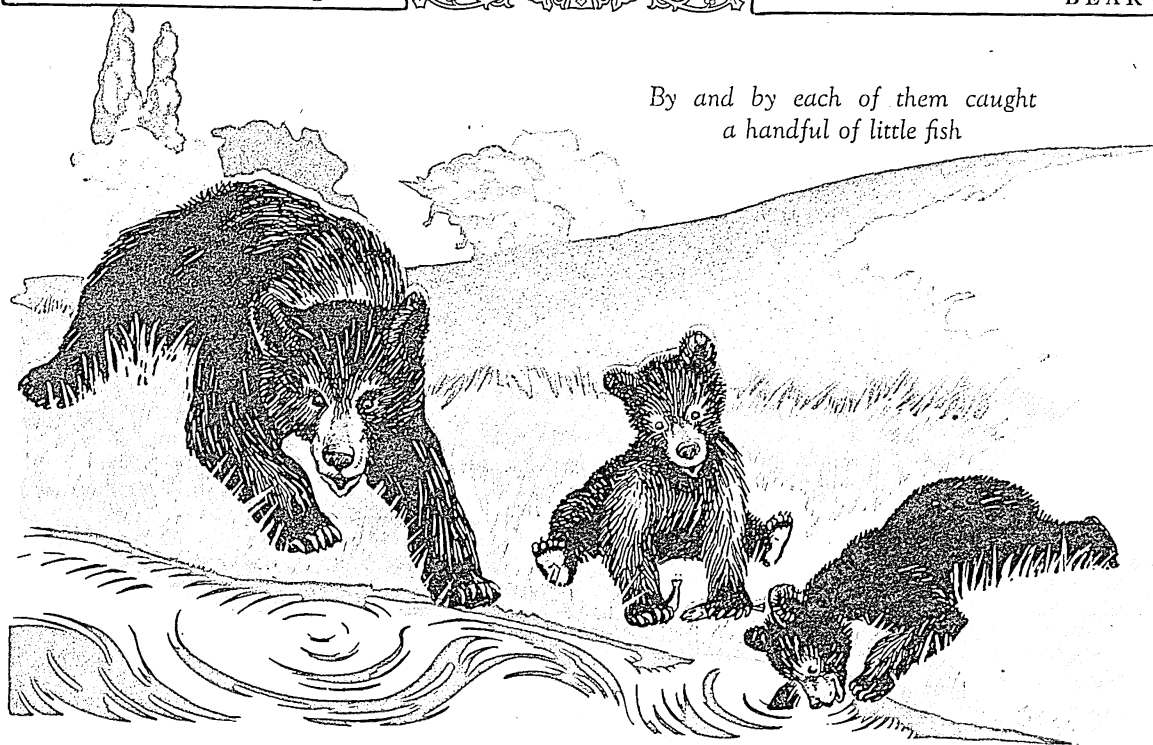
"Oh, dear!" cried Ginger, holding her paws to her tender little nose, "a bee stung me right on my nose!"

"Ouch!" Blackie cried at the same time, "a bee stung me on my head."

The mother bear kept on tearing at the stump with her strong claws. Her fur was so thick that the bees couldn't sting her easily. Even though one or two did sting her nose, she didn't mind much; she was so eager to get at the honey.

When the hole was big enough, she put in her paw and brought it out dripping with honey. "Delicious!" she said, as she licked off the sweet sticky stuff. Blackie and Ginger stretched up on their hind legs and

*By and by each of them caught
a handful of little fish*



put in their paws too. They gobbled down the honey as fast as they could. The angry bees stung them and the little bears whined and whimpered but kept right on eating.

"Wasn't it good?" Blackie said when all the honey was gone. "I wish we had honey every day."

"Well, I wish the bees wouldn't sting so hard," Ginger said, rubbing her sore nose.

"Come, children," their mother said. "We will go over to the shade, away from the bees, and take a nap."

The little bears were so full of honey that they were glad to lie down. Ginger dropped off to sleep at once. Suddenly Blackie raised his head.

"What's that, mother? What's that queer scratching sound I hear!"

"That is something you ought to know about. Come with me and I'll show you."

They waddled over to a clump of bushes near a tall smooth tree. The little bear looked through the bushes and saw a strange sight.

A huge bear was standing on his hind legs scratching on the tree as high as he could reach.

Blackie watched him a moment in silence. He couldn't understand what the bear was doing. He wanted to know. So he walked straight through the bushes and called out: "What are you scratching that tree for, Black Bear?"

The black bear stopped his scratching and looked down at little Blackie. "This is a scratching tree," he

said in a big gruff voice. "Don't you know what a scratching tree is?"

"No, I don't. What is it?"

"It is a tree that he-bears scratch on."

"Why do you scratch on it?"

"So that other bears that come along will know who has been here. Look! That is my mark—the one that is highest up on the tree. No other bear who has scratched this tree is as big and strong as I am."

Blackie stared at him with big eyes. "He's a terribly big bear, isn't he, mother?" he said. "I'd like to be as big as he is."

"Maybe you will be some day," his mother said.

When they got back to where they had left Ginger she was awake and ready to play again.

"Now what can we do, mother?" she said. "I'd like to do something I've never done before."

"How would you like to fish?" her mother asked.

"Is it fun?" asked the little bears.

"Lots of fun, and besides, fish are good to eat."

"As good as honey?" Ginger asked eagerly.

"They have a different taste," her mother answered, "but they're good."

Their mother took them down the hillside, along a path that other bears had made when they went to fish. Presently they came to a little stream. "Now watch me," she said, "and do just as I do."

She stood at the side of the stream and put her front paw in the water. For a long time she stood perfectly still, waiting. All of a sudden she scooped it

through the water with a splash and brought out a handful of little fish.

"Oh, let me taste them!" Blackie cried.

"No! You will never learn to fish if I feed you. You must catch your own food."

So the two little bears stood beside the stream and tried to do just as their mother had done. At first they only brought up water in their paws, but by and by each of them caught a handful of little fish. They felt very proud of themselves.

Suddenly the mother bear rose to her hind feet and moved her head from side to side, sniffing the air.

"Climb this tree, children! Quick!" she said. "I smell danger!"

"I'm too tired to climb," Ginger said.

"Go up this tree, as I tell you!" the mother said sharply.

Ginger moved so slowly that her mother gave her a push. Blackie followed a little more quickly. The mother bear, back of him, prodded him on with her nose until at last they were all safely up.

For a while they lay very still on a high branch and waited. The mother bear kept sniffing the air. Presently she said: "I think it was that cross old lynx we saw last week. But he's gone now. Let's go down."

Then they all three climbed down again—tail first. Blackie and Ginger were even slower coming down than they had been going up, because they kept looking

down over their shoulders to see where they were going.

"I don't like to climb trees," Ginger said. "It's too hard for little bears."

"Coming down is worse," said Blackie. "I can't see where I'm going."

"You must always climb a tree when you smell danger," their mother said. "Remember that, both of you."

The sun had set and the air was getting chilly. Blackie and Ginger were sleepy.

"Can't we go back to the den tonight, mother?" Ginger asked.

"No," their mother said. "We will sleep out in the woods all summer. When it gets cold we will go to our old den or find a new one and stay there until it is spring."

"What will we eat?" Blackie asked quickly.

"We will not eat," his mother told him. "We won't be hungry. Before we go into the den we will eat and eat and eat until we are very, very fat. Then we won't need food all winter."

"I like fish," Ginger said sleepily.

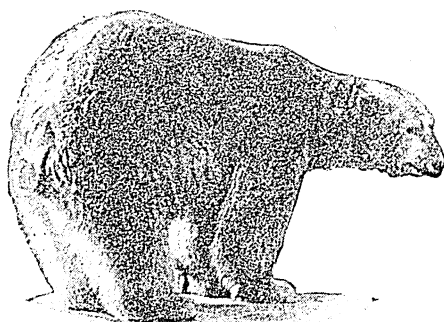
"I like honey better," said Blackie.

"Enough talking, children! Go to sleep!"

The two little bears were so tired with all they had done that day, that they were glad enough to cuddle close to their mother and close their eyes.

"Climb this tree! Quick!
I smell danger!"





The Polar Bear at the left is one of the most accomplished members of the bear family. He can swim fast enough to catch a seal, can run with surprising swiftness over the ice, and is a terrible fighter. The "Silver-Tip" Grizzly, at the right, is so named because the tips of the hairs in his coat are light gray. Heavy as he looks, this bear can gallop over rough ground at great speed.

grizzly bear would be in serious danger of being exterminated were it not for the protection given in the Yellowstone and other national parks.

The *Alaskan brown bears* are found only in Alaska. They attain the enormous weight of 1,500 pounds, and are not only the largest living bears, but the largest living carnivores which are found on land. Yet their existence was unknown before 1898. They fear man and flee his presence, but when wounded or suddenly surprised at close quarters, they will fight furiously. They hunt mice, ground squirrels, and marmots, digging them out of their burrows. They gorge on fish when the salmon come up the rivers. The Kodiak bear, a cousin of the Alaskan brown bear, lives on Kodiak Island. It is so much hunted that game laws protect it in certain seasons.

The *polar bear* is appropriately dressed in white to harmonize with its surroundings. It is completely covered, even to the soles of its feet, with long thick fur. It is a powerful swimmer and even in midwinter is perfectly at home in the water. Only the female polar bear hibernates. Her winter den is a cavity under the ice and snow, and there she brings forth her young. Until they are quite grown the cubs remain with their mother, who cares for them, teaches them, and protects them from harm. Dr. Nelson says: "When a mother polar bear scents danger she jumps into the water and her cub holds fast to her tail while she tows it to safety. But when no danger seems to threaten she wants it to 'paddle its own canoe,' and boxes its ears or ducks its head under water if it insists on being too lazy to swim for itself."

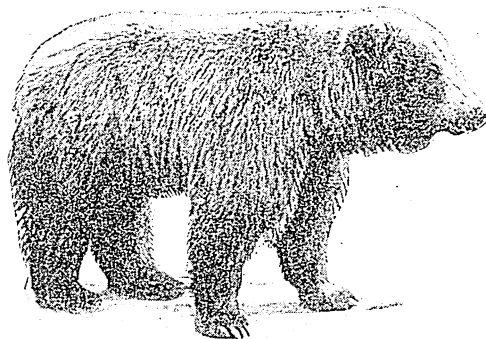
The male polar prowls about on the ice during the long winter night, subsisting on fish, seals, walruses, and any other food he can find. When in dire need he does not hesitate to attack men, and many an Eskimo

has fallen a prey to his attacks. In summer, when food is plentiful, he never attacks man except in self-defense.

Bears of Europe and Asia

The *brown bear* of Europe (*Ursus arctos*) resembles the grizzly more than any other American bear. It is larger than the black bear and more dangerous to man, although by no means as blood-thirsty as is commonly reported. It attacks man only when provoked or when suffering from extreme hunger. An account of this bear which tells how it attacked a camping party surrounded by a circle of fire, by first plunging into water and then rolling across the fire to extinguish it, makes a good story, but overstates the intelligence of this dull-witted creature.

The strength of the brown bear is almost unbelievable. It has been known to kill a cow and carry it across a small stream in its fore paws, walking upright on its hind legs. Another authentic account tells how it dragged a deer weighing 600 pounds from a pit and through the woods three-quarters of a mile. The range of the brown



This is the Brown Bear, who, although he lives in Europe, is very much like his American cousin, the Grizzly. For strength, as the article tells you, he is one of the Samsons of his race.

bear is from the Atlas Mountains in Africa across Europe and Siberia to Kamchatka.

The *Himalayan bear* (*Ursus torquatus*) is found in Asia from Persia to Japan. It resembles the black bear in size, color, and habits.

The *Malayan*, or *sun bear* (*Ursus malayanus*), is smaller. It inhabits the Malayan peninsula and the larger East Indian islands.

BEATTY (*bē'tē*), ADMIRAL EARL DAVID (1871-1936). During the last two years of the World War of 1914-18, the British Grand Fleet was under the command of Admiral Sir David Beatty, who by his skilled leadership was largely responsible for defeating the German submarine campaign.

Born of a good Irish family, he entered the British navy in 1884, becoming a commander in 1898, captain

in 1900, and rear admiral in 1910. In 1901 he married the daughter of Marshall Field of Chicago. He played a distinguished part in the World War from the beginning. In the battle of Jutland, May 31, 1916, he commanded the battle cruiser squadron, and engaged the numerically superior enemy in spite of heavy losses until the arrival of the dreadnought squadron under Admiral Sir John R. Jellicoe. Later in the same year he succeeded Jellicoe as commander-in-chief of the Grand Fleet. After the war he was created earl and served as First Sea Lord (1919-27).

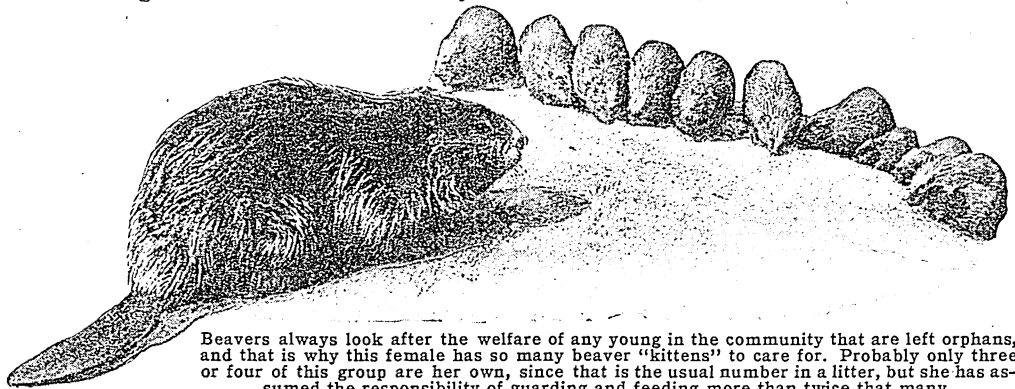
BEAVER. Have you ever heard the saying, "as busy as a beaver"? Anyone who has ever had the good fortune to see a colony of these water animals at work has no difficulty in understanding its meaning, for they are among the most intelligent and industrious of animals, and the dams and houses which they construct are wonderful products of animal skill.

The beaver belongs to the group of "gnawers" or rodents, and is the largest and heaviest of that family.

feet in diameter and two or three feet in height, and the floor is carpeted with bark, grass, and wood chips. There are two entrances, both under water. One, called the beaver entrance, is often winding in its course as a protection against enemies. The other is straight and is used both for taking in the wood for winter food, and as a means of escape in case of invasion by a mink or other water enemy. Both these entrances open into a moat around the house, too deep to freeze solidly, so that the beavers are not likely to be shut in.

Beavers as Engineers

In order that they may easily pass back and forth under the winter's ice, and that they may have room to store food, the beavers build dams to increase the water about the lodges. These dams are often of great size; indeed one is reported 1,530 feet long. The first step in dam-building is the selection of a suitable site, a narrow place in shallow water with firm bottom. Then work is begun of felling trees. Standing on



Beavers always look after the welfare of any young in the community that are left orphans, and that is why this female has so many beaver "kittens" to care for. Probably only three or four of this group are her own, since that is the usual number in a litter, but she has assumed the responsibility of guarding and feeding more than twice that many.

A large beaver measures about two feet from the tip of his nose to the root of his tail, which adds about a foot more. The weight of such a specimen is about 35 pounds, but large old specimens may weigh 75 pounds. The tail is not the least curious feature of the beaver, for it is broad and flat with a horny covering resembling scales. The front teeth are remarkably large, and like the front teeth of the squirrels, rabbits, and other gnawing animals, are hard in front and softer behind, so that by use they become worn to chisel edges. The beaver's hind feet are webbed for swimming and the flattened tail serves as a rudder and to splash the water for a warning signal. He is a splendid swimmer and diver. Frequently he remains under water for fully two minutes.

Beavers are social animals. A family of several members usually lives in one house; and sometimes a large number of families collect together in a community. They usually work at night and build their houses or lodges well concealed from haunts of man in small lakes or ponds made by damming up a forest brook. Their houses are oven-shaped and built of sticks, grass, and moss, woven together and plastered with mud, so strong as to protect the inhabitants from beasts of prey. The room inside may measure eight

feet in diameter and two or three feet in height, and the floor is carpeted with bark, grass, and wood chips. There are two entrances, both under water. One, called the beaver entrance, is often winding in its course as a protection against enemies. The other is straight and is used both for taking in the wood for winter food, and as a means of escape in case of invasion by a mink or other water enemy. Both these entrances open into a moat around the house, too deep to freeze solidly, so that the beavers are not likely to be shut in.

Some say that they always plan for the tree to fall toward the water; others declare that they work haphazard. After the tree is down the beavers set to work lopping off branches and cutting the trunk into lengths which they can drag into the water. The short logs, dragged or floated to the desired spot, are sunk parallel with the current, and if the water is deep they are kept down by means of stones, sod, and mud loaded on by the beavers. Mud and stones and heavier timbers are carried in their forepaws and small timber between their teeth. There is no superintendence in their work, but each beaver does what seems to him best. The result is that the dam is usually a tangled heap, but it serves its purpose. In old dams willow and poplar logs have usually sprouted and have sometimes given rise to considerable trees.

The beaver feeds mainly on the bark of trees (willow, poplar, birch, etc.), and on roots, buds, berries, and leaves. A store of good-sized green logs is always sunk in the water at the doors of their houses for winter feeding. When the trees near the water are

A PICTURE-VISIT TO A BEAVER POND



The artist shows us a beaver "lodge" with one side cut away so that we can see how cleverly it is constructed, both above and below the water line. The floor of the well-kept, neat interior is built on two levels, as a protection in case the water rises during the spring thaw. All the entrances, like the one shown, are designed to be below the thickest ice that may cover the pond in winter. The beaver swimming toward the lodge is bringing a green branch, the first of the yearly harvest, to store just outside the underwater doorway. As a beaver colony grows, additional dams are built downstream to provide pools for new houses.

used up and the land is too uneven for rolling, log-slides and canals are cut in the banks and bottom to carry down the timbers. These channels may be hundreds of feet long and about a yard in width and depth. One of the chief uses of the beavers' dam is to insure sufficient water to float these logs.

The soft thick gray under-fur of the beaver has long been highly valued by man, and during the 17th and 18th centuries beaver skins held first place in the world's fur trade. At that time, before the invention of the modern silk hats, men's hats were made from beaver skins and hence the word "beaver" often meant "hat." So great was the demand for beaver fur that in the western part of Canada and the United States beaver skins at times passed as currency.

Beavers once inhabited most of the wooded parts of the Northern Hemisphere, but they have now been exterminated over much of their former range. In Europe only a few scattered colonies survive. In the

United States they are scarce east of the Rocky Mountains, though they have recently been increasing in Maine and other states which have passed laws for their protection. They are increasing also in the Western states and in Canada, wherever a policy of conservation has been adopted. Some states have started new colonies by bringing in a few pairs from other states.

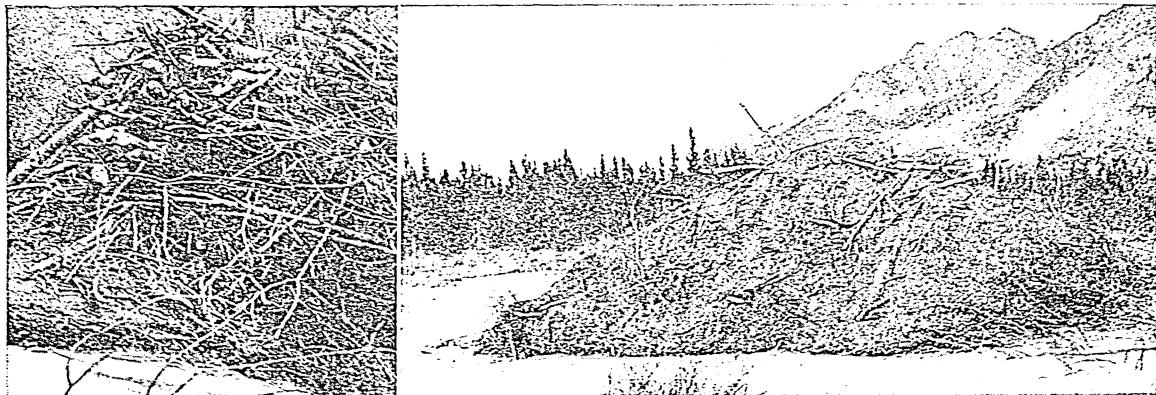
HOW THE BEAVER CHOPS DOWN TREES



Beavers cut down trees by gnawing through them with their sharp front teeth at the distance above the ground they can reach when standing upright. The tree is generally gnawed pretty evenly all around, as you can see from these two stumps. The wood is usually cut away in very large chips.

Friends of the beaver have encountered bitter opposition because of the damage it sometimes causes by flooding tracts of valuable timber. Its good deeds, however, outweigh the bad. By building a series of

THE BEAVER'S TIME LOCK THAT KEEPS OUT HIS ENEMIES



During the long cold winter, while the beavers are dozing quietly in their warm houses, the beasts and birds of prey are desperate for food. They rarely catch a beaver, however, for the beavers' lodges are time-locked fortresses. In the fall the lodge looks as it does in the picture on the left; but before the cold strikes, the beavers plaster it over with thick mud. This soon freezes solid, as shown in the picture on the right. No wolverines, lynxes, wolves, or even bears can break in.

dams in mountainous districts, the beavers form ponds which hold the waters of the melting snows and give them out gradually during the summer to the arid plains. Thus they help to irrigate the land. Moreover their great economic value as a source of fur and their interesting habits should alone be a sufficient argument in favor of protecting them.

Scientific name of North American beaver, *Castor canadensis*. The Old World beaver (*Castor fiber*) was formerly common in England, France, Germany, and elsewhere, but it is now practically unknown except in some parts of the Scandinavian peninsula, Germany, and Siberia.

BECKET, THOMAS, ARCHBISHOP OF CANTERBURY (1118-1170). In the majestic cathedral of Canterbury, England, is a chapel where once stood the shrine of the murdered Archbishop Thomas Becket. The shrine is no longer there, but the steps which led up to it still stand, worn into hollows by the knees of countless pilgrims. For three centuries this was one of the most sacred spots in Christendom, and streams of religious pilgrims constantly thronged the road from London to Canterbury, jogging along at the leisurely pace which we call a "canter," and beguiling the time with such pleasant stories as Chaucer has preserved for us in his 'Canterbury Tales'.

The saint at whose shrine they came to worship was a London merchant's son, who had first risen to be chancellor, chief minister, and bosom friend of King Henry II. Thomas was 15 years older than his royal master, but had endeared himself by his love of fun and sport no less than by his sagacity in matters of state. The tall dark handsome Thomas, who loved splendid clothes and lavish living, must have been a striking contrast to the freckled red-haired sturdy king; but the two became inseparable, working and hunting and romping together like two schoolboys.

But this friendship was soon to turn to the bitterest enmity. Wishing to bring the church under the power of the state, Henry appointed his boon companion to the highest church office in England, that of Archbishop of Canterbury. Thomas stoutly protested, for

he had been the pupil of the former Archbishop, and he knew that in that office he would be forced to resist the king's attempts to weaken the church's power.

But Henry blindly persisted, and Thomas straightway, from the gayest of the gay, became a devout and jealous defender of the privileges of the church. The clash was not long in coming. The burning question of the time was whether churchmen should be subject to the king and his courts, or only to the Pope and the ecclesiastical courts. Unfortunately this "benefit of clergy," as it was called, extended not only to priests but to everyone who had ever received the "tonsure"; it thus permitted many persons who were practically laymen to escape due punishment for their misdeeds, for the church law forbade the death penalty.

Becket boldly stood out against Henry when he tried to lessen the independence of the clergy, and a furious quarrel began. One stormy night Becket fled in disguise to the court of Henry's enemy, the King of France. Henry seized Becket's revenues and exiled his relatives, but after several years a peace was patched up and Becket was allowed to return to England. His first act was to excommunicate those who had illegally, as he believed, executed the king's commands in his absence. This fresh act of defiance stung the quick-tempered monarch to fury.

"My subjects are sluggards, men of no spirit," he cried. "They keep no faith with their lord; they allow me to be made the laughing-stock of a low-born clerk!"

So, four of the king's knights, hearing these words, took passage hastily across the Channel—for the king was in Normandy—proceeded to Canterbury, and slew the archbishop with their swords on the altar-steps of his own cathedral.

This savage deed shocked all the Christian world. Henry was forced by the Pope to do bitter penance, and the dead archbishop was regarded as a martyr. The Pope declared him a saint, and his shrine remained the most hallowed spot in England until the Reformation, when it was destroyed by Henry VIII.

In the WORKSHOP of the BEES

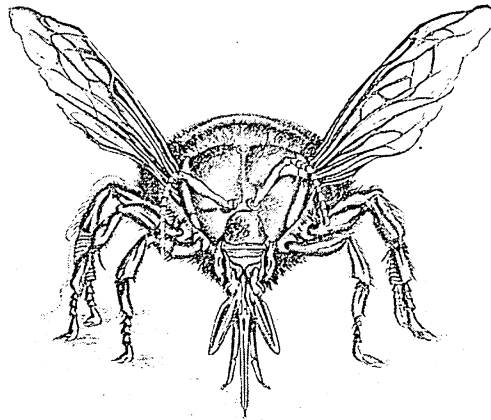
BEE. As an architect, the bee—especially the honey-bee—is not surpassed by any member of the animal kingdom except man. The structure of a honeycomb is perfection in the way of strength and space for holding fluid contents. Maurice Maeterlinck, the renowned Belgian poet, whose 'The Life of the Bee' is one of the most interesting books in literature, thus describes the inside as it would look to us if we could see it through the eyes of the bee:

"From the height of a dome more colossal than that of Saint Peter's at Rome, waxen walls descend to the ground, gigantic and manifold, vertical and parallel geometric constructions, to which, for relative precision, audacity, and vastness, no human structure is comparable. Each of these walls contains thousands of cells that are

stored with provisions to feed the whole people for several weeks. In the center there stands the royal domain of the brood-cells, set apart for the queen and her attendants—about 10,000 cells wherein the eggs repose, 15,000 or 16,000 chambers tenanted by larvae, 40,000 dwellings inhabited by white nymphs to whom thousands of nurses minister. And finally, in the holy of holies of these parts, are the three, four, six, or twelve sealed palaces, vast in size compared with the others, where the adolescent princesses lie, who await their hour, wrapped in a kind of shroud, all of them motionless and pale, and fed in the darkness."

Wonderful structures

In all the wonder-book of nature there is no story more amazing, more fascinating, more instructive, than the life-history of the bee. Wise men have been studying this mysterious little insect for centuries, but we still have much to learn about it. The skill, the ingenuity, the devotion of the bee are marvels that astonish us the more, the better we come to know them.



In this highly magnified view of a bee you see how the sensitive feelers grow out of the middle of the face. Beneath the head are the delicate mouth parts making up the proboscis, which is usually folded back beneath the head. In the center of the proboscis is the slender flexible grooved tongue with which the bee gathers nectar.

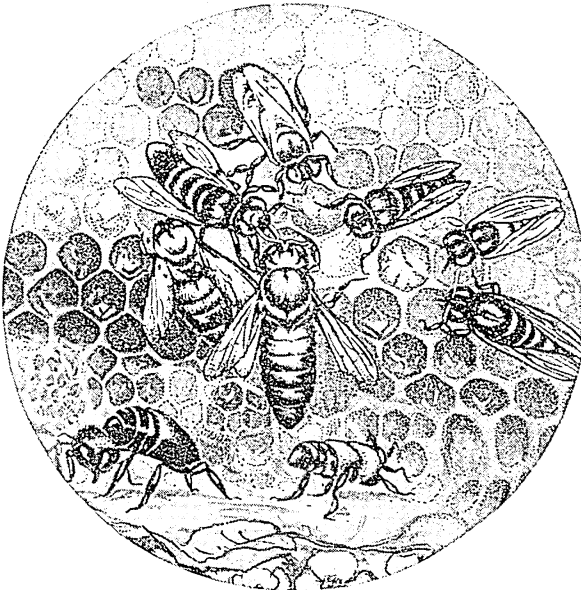
like this can of course be made only by highly developed communities, such as are formed by the honey-bees. Honey-bees and bumblebees are called the *social* bees, because they live all their lives in great colonies. A single swarm of honey-bees may contain from 10,000 to perhaps 80,000 individuals. All the other families of bees, which nest by themselves, are called *solitary* bees. Each mother of these species provides a nest for her young, which no longer live together when they have grown to adults.

The honey-bees which we see flitting from flower to flower in garden and meadow have the most complicated social organization of all the animals, with the possible exception of the ants. They live in a republic where the citizens do all the governing without voting, where the many kings are powerless, and the one much cherished queen works as hard as any of her subjects, and longer. Honey-bees are perfect socialists; they labor without competition or personal reward, and they have everything in common. They are divided into castes, as workers, queens, and drones, but these castes exist for the benefit of all, not for their own private advantage.

Where the Females Do the Work

The worker honey-bee is merely an undeveloped female, specially changed physically to carry on the labors of the colony. Her brain is much larger than that of the queen or the drone. She has combs on her hind legs to collect the pollen from

A QUEEN AND HER ATTENDANTS



A queen and her attendants are just taking possession of a row of cells in a new hive. The queen is preparing to lay an egg in one of the cells, while the members of her escort encircle her, prepared to feed her or assist her in every way.

flowers, and baskets to store it in. She has a system of chemical laboratories within herself, in one of which she changes the nectar of the flowers to honey. In another she produces food for queens, and in another she changes honey

into wax. The duties of the worker bee are many. When she first matures she has to feed the little bee grubs or *larvae*, and keep the hive clean and ventilate it by fanning it with her wings. Later she learns how to take wax and build it into a honeycomb—or to hang up claw in

claw with her sisters and gorge with honey in order to give forth little scales of wax from the glands on the lower side of her abdomen. She gathers nectar from flowers, ripens it into honey, and stores it away in the cells of the honeycomb. She gathers pollen, bringing it home in her pollen basket and then scraping it off into a cell, where she tamps it down with her head to make it into solid "bee-bread" to be fed to young bees. If the colony is attacked she must join in the battle to defend it. She may have to help exile her drone brothers when the time comes to get rid of them; or she may be waiting-maid to the queen, feeding and caring for her tenderly and producing from her own glands the rich food necessary to the royal mother. She may have to gather bee-glue from leaf buds to calk the crevices of the hive, or she may have to hunt a suitable new place for housing a swarm that is soon to come out.

Whatever her duties, she works with all her might and without any consideration for herself. She will starve herself to feed the queen; she will fight any enemy with the utmost recklessness; she will work at bringing in food until her frayed wings can no longer carry her; and at the end of her short and laborious life she falls by the wayside to die, neither expecting nor desiring any help from her sisters. There is no gratitude or pensioning in the bee colony. The individual is nothing; the community is everything.

The life story of the bee begins with the tiny white egg that the queen lays in a cell of the honeycomb. The egg stands up straight and is glued at one end to the bottom of the cell. After three days a little white grub hatches from it, and is continuously fed by the nurse bees. It grows until it fills almost the entire cell. The bees then cap the cell with a mixture

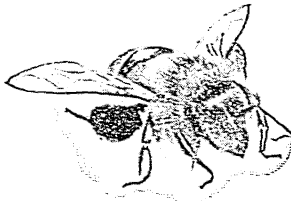
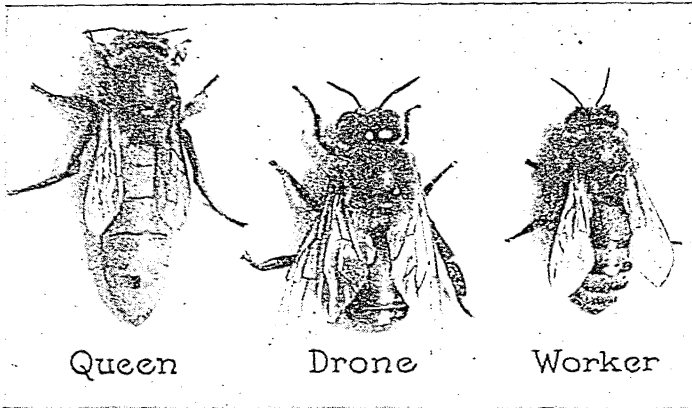
of wax and pollen which is porous enough to allow the air to circulate. Meanwhile the larva lines the cell walls with a fine silken cocoon, within which it changes to a *pupa*. After gnawing through cocoon and cell cap, the full grown bee emerges.

During the first three days the little larva is fed in abundance. It actually swims in the rich creamy food which is prepared by the nurse bees. The next three days the diet changes in quantity as well as quality. Only honey and pollen

serve as food, and these are fed to the larva in measured quantities. These six days of larval life are followed by 12 days in the pupal stage, so the whole development from egg to adult lasts 21 days.

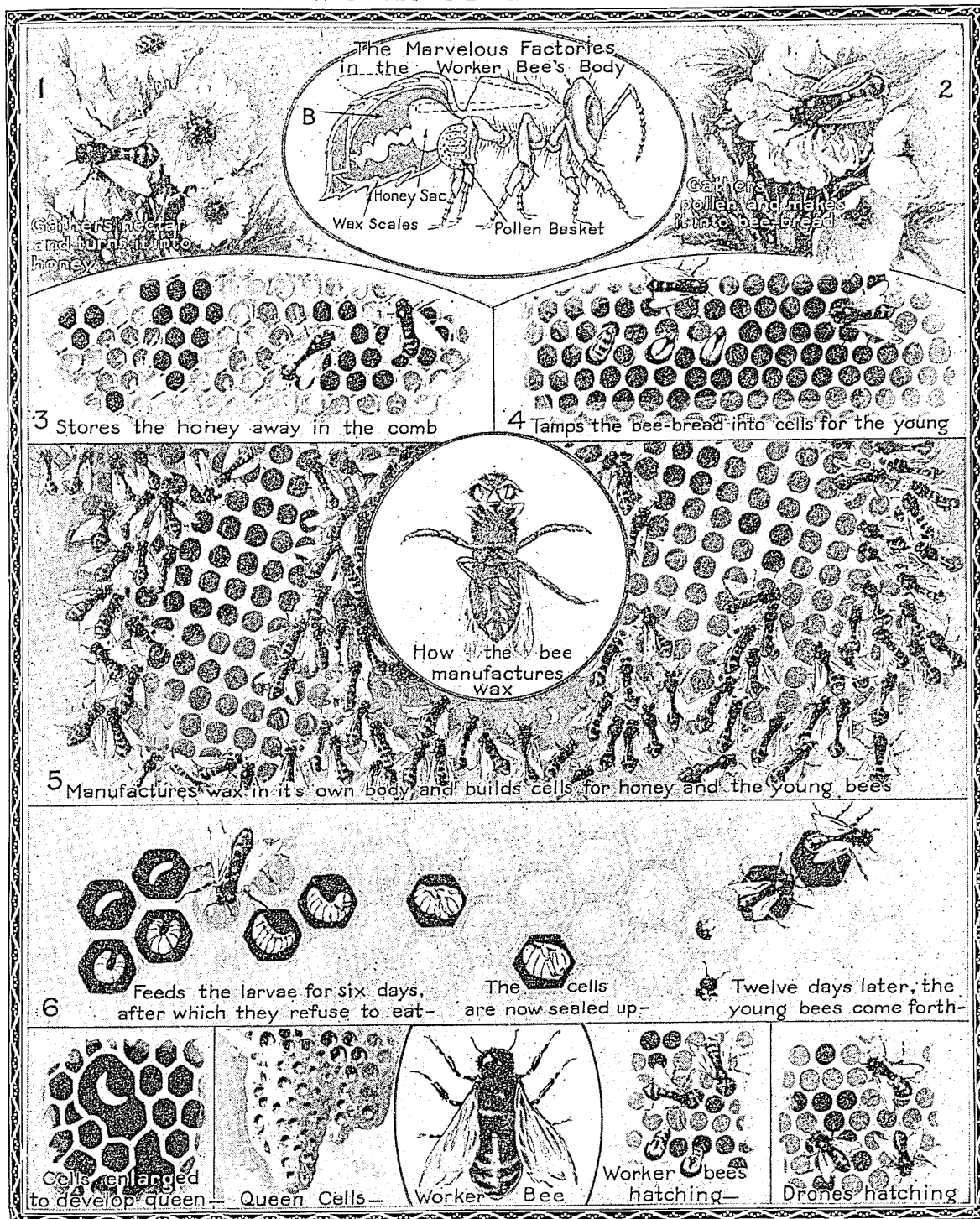
The queen takes only 16 days to develop. She comes from the same kind of egg as the worker, but is reared in a different cell, the so-called queen cell. A queen cell, which is much larger than a worker cell, is attached vertically to the comb. The queen larva during the six days of larval development is fed with a rich substance called "royal jelly," which is deposited at the base of the queen cells in such abundance that after the larva ceases to feed a great quantity of royal jelly still remains in the cell. Seven days after the royal cell was sealed a young queen emerges. She soon starts searching for a rival within the colony. If another queen matured at the same time, the two battle until one is killed, fighting with a royal weapon—a sting curved like a scimitar, which the queen never uses upon anything or anybody except her own kind.

Five or six days later, when the weather is sunny, the queen will fly from the hive seeking her mate. After mating she returns alone to the hive, capable of laying fertilized or unfertilized eggs at will. The fertilized eggs develop into workers and queens, the unfertilized into drones. She soon commences her great work of egg laying, thrusting her abdomen into cell after cell and leaving an egg on the bottom of each. Just before the height of the honey season she sometimes lays as many as 2,500 eggs a day—twice her own weight. When the honey flow slows down she lays fewer eggs. The number is determined by the workers, who regulate the amount of food given to the queen according to the number of eggs needed. The queen may live five years or longer, while the



A worker just returned from "marketing" in the fields, with the pollen basket on the hind leg as full as it can be.

DAILY WORK OF THE HONEY BEE



and carried to the hive in the two pollen baskets on her hind legs. She puts it into a separate cell (4), where it turns into bee-bread. The pollen baskets may be used also to bring in resin collected from tree buds out of which the bees make a glue called "propolis." This is used to patch up holes in the hive. To make wax a large number of bees stuff themselves with food and hang to one another like a curtain from the roof of the hive. As the wax forms and comes out through the scales on their abdomens, other bees scrape it off. The life of a worker bee begins with the hatching of the egg three days after it is laid. The pictures (6) show how the changes from the larva stage to the adult stage take an additional 18 days.

worker in the busy season may wear herself out in six weeks.

Bee colonies spread by swarming to remedy an overcrowded condition of the hive. A young queen is reared early in the season. Usually before the young queen emerges from her cell, the old queen, followed by a large number of workers, departs for another abode, which, unless controlled by man, is some place selected by a worker scout. Those left behind are mainly young workers.

The Life of the Drones

The drone or male bee has the least fortunate lot of all the bee citizens. In order that one drone may fulfill his destiny of mating with the queen, many are born only to be slain when the food supply runs low. The luckless drone is denied a share in all activities in the community. He is a clumsy broad blunt-ended bee, fitted for a life of idleness. He has no pollen baskets on his legs, no wax glands in his body; worst of all, he has no sting to protect himself, and his tongue is not long enough to reach nectar in the flowers. But his wings are large and strong, to carry him miles in search of a queen; he has very large eyes—with 8,000 to 10,000 facets—and his antennae are fitted with smelling pores so that he has about 2,600 tiny nostrils wherewith it is said he detects the fragrance of his mistress' royal person.

The drone is reared from an unfertilized egg laid in a cell larger than that of the worker. He spends six days as a larva, 15 days as a pupa. Twenty-four days after the laying of the egg he cuts a lid in the cap which the workers have made over his cell and crawls out, to move about on the comb and to receive food from the workers. After about two weeks he begins making flights, hunting for a queen; but when he finds her his happiness is brief, for he dies immediately after mating. If he finds no queen consort, his lot must puzzle him; for his sister workers, so kind to him always before, harry him fiercely when autumn approaches, deprive him of food, and gradually push him out of the hive to perish.

Not content merely with the riddance of the adult drones, the workers turn upon the drone brood and sometimes upon their own worker larvae and pupae, destroying and killing to reduce the community to safe winter numbers. From 50,000 or more individuals in the summer to 10,000 in the winter is the drastic reduction which occurs in the bee community.

The Harvest of the Hive

A golden harvest comes dripping from the hive of the honey-bee to add \$30,000,000 every year to the wealth of the United States. Honey, a natural and highly nutritious food, is valued as a table delicacy, in home cooking, and in the preparation of confections,

and is particularly recommended in the diet of invalids and children. Its soothing qualities make it a common ingredient in cough medicines. To the ancients, honey was almost the only available source of sugar, and no finer tribute could be paid to any country in Biblical times than to call it "a land flowing with milk and honey."

Canada and the United States have developed apiculture to an important extent. The brands of honey range into the hundreds and take their characteristic flavor or color from the source of the nectar. Honey made from sage is water-white; it is light amber when made from mesquite, white clover, or alfalfa; slightly green from sweet clover; and dark purple from buckwheat. California and Texas lead all the other states in honey production. Iowa, Illinois, and New York also rank among the leaders.

After the storehouses of the bees have been despoiled of honey, the walls of the comb are melted down and the resulting product after purification goes on the market as beeswax. Commercially, it is employed in making church candles, wax polishes, and ointments. The dentist takes an impression of your teeth in beeswax, and the cobbler waxes his thread with it. Many life-like models in museums and store windows are made partly from beeswax.

Apart from the business of honey and wax production, bees act as necessary agents in bringing about the pollination of blossoms, and so carry on a work of incalculable benefit to farmers and fruit growers. Orchard owners on the Pacific coast actually rent bees to insure pollination of the blossoms and thereby secure a heavier yield of fruit. In favorable seasons bees do not as a rule go more than two miles from the hive in searching for nectar.

Honey-Bees from the Old World

There are no honey-bees native to America north of Mexico. Our wild honey-bees are colonies that have escaped from apiaries (places where bees are kept) and have found homes for themselves in hollow trees. The first bees brought over were the German or black bees. The Italian bees, which are more gentle and have longer tongues, have become universal favorites. Caucasian bees and Carniolans are also gentle and have some advocates. Other races like the Cyprians, Syrians, and Egyptians have also been tried but have been found to be undesirable.

The bumblebees are also social, but they have not reached the efficiency of the honey-bee. However, they are very important as pollen carriers for thousands of plants, because they have long tongues and so are able to take nectar from deep flowers which

A SWARM



Somewhere in the center of this living mass of bees is an old queen, driven from the hive by jealousy. Around her, hanging to each other by their claws, are her faithful workers.



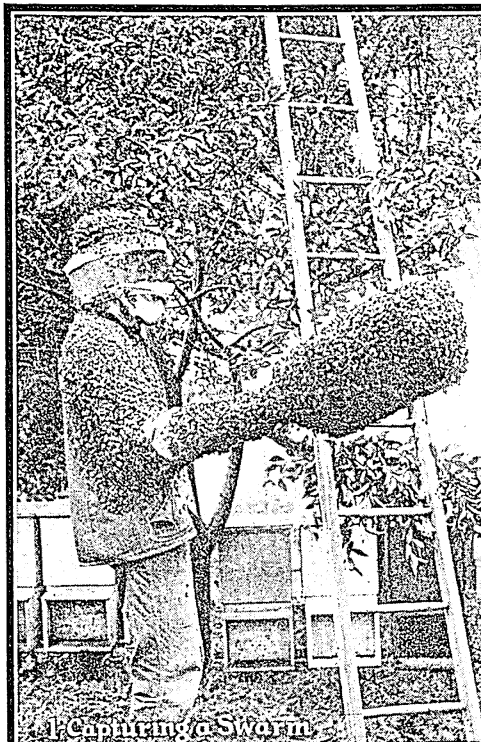
From a painting by Bruno Ertz

Five times actual size

A BUMBLE BEE OPENS A SNAPDRAGON

The snapdragon's "mouth" closes tightly over its treasure of nectar, keeping out honey bees and other smaller insects. But the weight of the great bumblebee pulls down the flower's lip and lets the hungry robber climb over and plunge in.

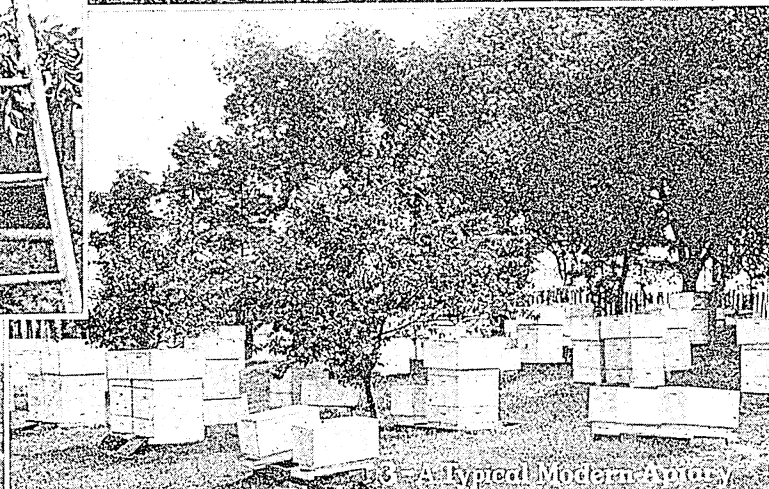
HOW MAN MAKES HONEY-BEES WORK FOR HIM



1-Capturing a Swarm



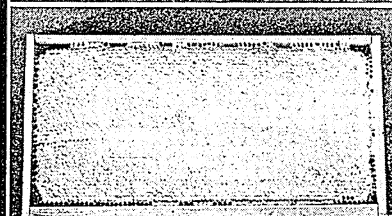
2-Swarm Enters New Hive



3-A Typical Modern Apiary



4-Ready to Open Hive



5-A Full Comb



6-Extracting the Honey



7-Bees in Winter

1. Protected by a bee-veil and gloves, the bee-keeper is carrying the bees in a hand basket to a new hive. 2. These man-made hives consist of two or more sections: the bottom one, where eggs are laid and the young are cared for; the upper sections, where surplus honey is stored. 3. The success of the bee farmer depends on his ability to keep his temperamental insects contented and well supplied with near-by sources of nectar. 4. The bee-smoker in the boy's hand holds hot coals and green

leaves to make a dense smoke which is pumped through cracks in the hive by means of the bellows handle. This stuns the bees slightly and keeps them quiet, while the hive is opened. 5. To get good even combs, the bee-keeper provides frames with the ground pattern of the comb already started in wax. 6. The top of the comb is shaved off and a whirling extractor throws the honey out of the cells. 7. Packed leaves keep the bees and the honey left to them for winter food from freezing.

other insects cannot reach. This fact is important to growers of red clover, for only such long-tongued insects as bumblebees can reach the nectar and thus carry the pollen for this important plant. The sight of a bumblebee should warm the heart of every lover of flowers, and bumblebees should be protected.

In early spring we often see a great bumblebee queen or mother flying low over the freshening meadows, hunting for the deserted nest of a field mouse or some other suitable cavity for a home. Finding a cozy place, she toils early and late gathering pollen and nectar from all flowers in bloom. This she mixes into an irregular mass of solid "bee-bread," upon which she lays a few eggs, gradually adding to the pollen mass until the first brood is hatched.

The little bee grub, as soon as it is hatched, burrows into the bee-bread, making a little cave for itself as it eats. After it is fully grown it spins a silken cocoon about itself, and later comes out a worker bumblebee. She and her sisters at once set about gathering pollen and nectar, thus relieving the queen mother from the work of providing food, so that she can give all her energies to the sole

The queens are the only members of the whole colony of hundreds of workers and drones that are strong enough to stand the cold of winter. Thus each bumblebee colony lasts only for one season, while the honey-bees pass the winter in a semi-dormant state.

The hairy body of the bumblebee is of great use in brushing and holding the pollen when she is working on flowers. After she is well powdered she alights on some leaf, and with the most strenuous and comical efforts combs the pollen out of her fur with special combs on her legs, and packs it in her pollen baskets on her hind legs.

The Melipones and Trigones of South America also belong to the group of social bees, but are stingless and smaller than the others.

"Trades" among the Bee People

Among the most common of the *solitary* bees are the carpenters, the leaf-cutters, and the miners. The mother carpenter bee bores a tunnel in soft dead wood by cutting out the chips with her jaws. The tunnel leads straight in for a short distance and then downward, and it is just large enough for her to move in comfortably. After the tunnel is completed she gathers pollen and nectar from flowers, and mixes them into a ball. Then she lays an egg upon this pollen mass. Next she gathers some of the chips cut out in making the tunnel and glues them together with saliva, making a little partition above the pollen mass. This acts as a floor for the next cell, in which she places another pollen ball and another egg. She thus makes several cells, in each of which a young bee hatches from the egg and develops to maturity upon

THE CARPENTER BEE'S APARTMENT
The many-storied apartment houses, which the Carpenter bees dig in the trunks and branches of trees, would look like this if you cut the wood away. On the top floor the mother bee is preparing a mass of bee-bread and honey. In this ready-to-eat loaf she lays her egg, and the loaf serves both as a cradle and a pantry for her infant when it hatches. On the floor below is an egg, laid, perhaps, the day before, and protected by a partition of chewed-up wood pulp as firm as plaster. Below that a grub has hatched out and is eating its bread and honey. On the two lower floors the young bees have reached the chrysalis or "sleeping" stage, during which their legs and wings develop. They will soon be ready to come out, but will have to wait until their youngest sister on the top floor matures. Then each tenant will bite a hole in her own ceiling and all will march out at once through the roof, and the one that hatched from the first egg laid is always the last one to leave the nest.

duty of laying eggs. These daughters tend the growing family with the most devoted care, and later strengthen the silken cocoon cradles with wax, making them into cells in which they store honey. Late in the season a few queens are developed from the eggs laid by the queen, and a few drones to be mates for the queens.

the "bee-bread" she has provided. When they are fully grown each young bee tears down the partition above him, and they all come out into the world in single file, the youngest first.

Not all carpenter bees bore into solid wood, for many species bore out the pith in the dead twigs of sumac, elder, raspberry, and other bushes. Some

carpenter bees are leaf-cutters also, lining their nests with pieces cut out of leaves, especially rose leaves, and making the partition above the cell with circular pieces cut from the same leaf. Leaf-cutter bees are very clever in saving themselves the trouble of boring out a nest, and often use crevices between the shingles or even the holes in awning rods. Some especially dainty species line their nests with pieces cut from the petals of pansies and other flowers. These carpenter and leaf-cutter bees vary in size from that of a small bumblebee to a tiny creature scarcely a quarter of an inch in length.

The miners bore their tunnels into the ground instead of into wood, and make tiny cells branching off the main tunnel to receive the eggs. The walls of the cells are glazed so that they look like the inside of an earthen jug. In each cell is stored pollen and nectar paste; then an egg is laid and the cell closed until the pupa is grown up and pushes out. While each mother miner digs her own nest, many of them may live as neighbors in villages. Sometimes a square rod of ground will include thousands of burrows. Some of the miners are as large as honeybees, but one species of miner is the smallest of all bees—less than a quarter of an inch in length. These tiniest of bees usually mine in the face of cliffs or sandbanks; which look as if they had received a charge from a shotgun.

The carpenter and

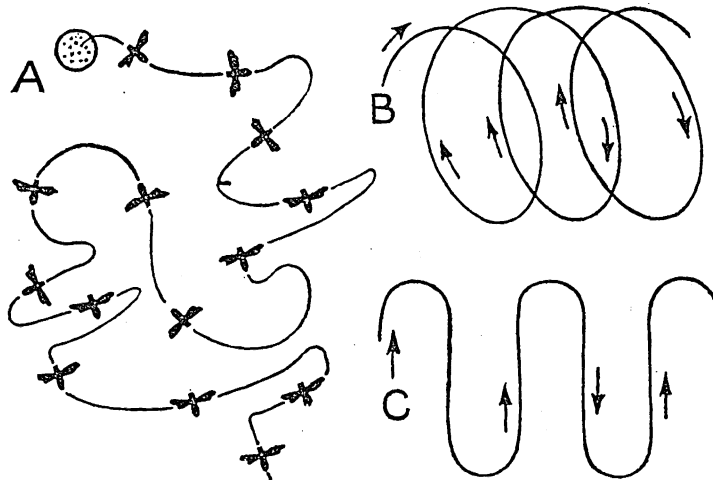
mining bees do a very important work in carrying pollen from flower to flower in the early spring, thus providing for their reproduction. Among the solitary bees some called *inquilines* are loafers and sponge

their living in the nests of other bees, just as the cowbird does in the nests of other birds. But no creature can become a parasite and get off without punishment. These lazy bees have degenerated in form and have lost all power to live independently.

Bees constitute the superfamily *Apoidea* of the order *Hymenoptera*, which includes bees, ants, sawflies, wasps, ichneumon flies, and their allies. The hive bees constitute the family *Apidae*; scientific name of common honey-bee, *Apis mellifica*. Bum-

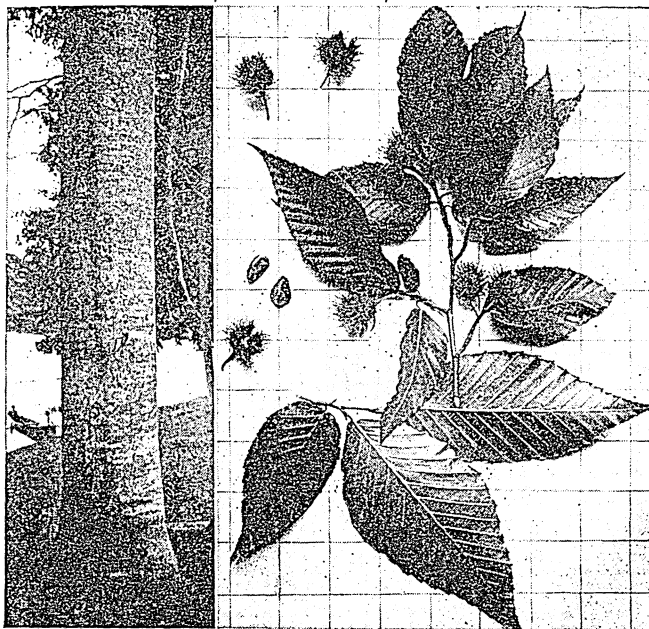
blees belong to the family *Bombidae*. The bee has four wings, the hind pair the smaller; its mouth parts are fitted for biting and sucking, and the basal segment of the foot is broadened and fitted for carrying pollen from flowers. The young of all bees are grublike.

THE LANGUAGE OF THE BEE'S FLIGHT



Every movement of a bee has a meaning for those who understand the language. Here we see (A) the typical course of a bee approaching a blossom; but when this bee has taken on its load of pollen or nectar, it returns to the hive in a path so straight that we use the expression "bee-line" for the most direct route possible. Back in the hive, the returned bee moves about on the comb, performing the honey dance (B) which says "I've found some nectar," or gracefully does the pollen jig (C) which tells her companions "I've found some pollen."

BEECH TREE, BEECH LEAVES, AND BEECH NUT



On the left is a fine beech tree with its smooth, light gray bark. On the right are the leaves, the burrs, and two of the toothsome kernels, lying on a screen of inch-squares to show their size. Beechnuts not only delight boys and girls, deer and squirrels, but contain a valuable oil.

BEECH. The stately beech tree grows for 50 years before it bears its peculiar pyramid-shaped nuts, but it makes a beautiful shade tree much earlier. The life of the tree is about 250 years. The American beech (*Fagus americana*) grows to be 80 feet high or more, and about 3½ feet in diameter. It has a smooth light-gray bark, a broad rounded top, and serrated leaves that turn yellow and brown in autumn. The European beech (*Fagus sylvatica*) often grows 100 feet high or more, and has dark-gray bark and shining leaves which remain

on the tree most of the winter. The beautiful beeches of England have long been famous, as are the beech forests of Denmark and Germany. One of the most beautiful varieties is the copper beech, which is native to Europe, distinguished by its red sap and leaves.

Beechnuts with other "mast" or forest nuts supply pasturage for deer and swine, and boys and girls can testify to the toothsome-ness of the tiny kernels. Beechnut oil is sometimes used in Europe for cooking, salad dressing, and lighting. The wood is hard for water to penetrate and hence is used in France for making wooden shoes. It is also much used for flooring and building timber, and for charcoal, and is distilled to make the finest kind of creosote for medicinal use (see Creosote).

BEET. It was said of Napoleon that he would go down in history with a sugar beet in one hand and the Code Napoleon in the other. It is true that the great emperor did much to encourage beet-growing, because of England's practical monopoly of the colonies which produced sugar cane; but we are chiefly indebted for our temperate-zone sugar production to the scientists of the 19th century, who developed the beet from a root producing only seven per cent sugar to one which is almost one-fifth sugar, and who are still working to improve the sugar content by seed selection. This remarkable advance in the last 50 years provides an admirable illustration of what can be done by applying scientific methods to agriculture. (See Sugar.)

Besides the sugar beet, which is usually whitish or yellowish, several other species are cultivated. Of these the garden beet is the best known, with its red root and rather small top. Chard (also called Swiss chard) has tall tops with large succulent leaf stems which are cooked and eaten somewhat like asparagus. Mangels, or "mangel-wurzels," are very large varieties of beet grown for stock feeding. Foliage beets, which have beautifully colored leaves, make excellent borders in garden beds.

The beet (*Beta vulgaris*) belongs to the family *Chenopodiaceae*. It is mostly biennial. It is found growing wild in sandy soil around the Mediterranean, and has been culti-

vated for about 2,000 years. Like all root crops, the beet needs a loose, light, rich soil, which must be in the best condition of tillage.

BEETHOVEN (*bā'tō-vēn*), **LUDWIG VAN** (1770-1827). Suffering and success play equal parts in the life of the great musician Beethoven. The story begins with tears, for at the age of four—to satisfy a selfish father—wearied, hungry, and cold, he was forced to spend hours at the violin and clavier (an early form of the piano). It reaches a double climax in the episode of the memorable concert, when, after the

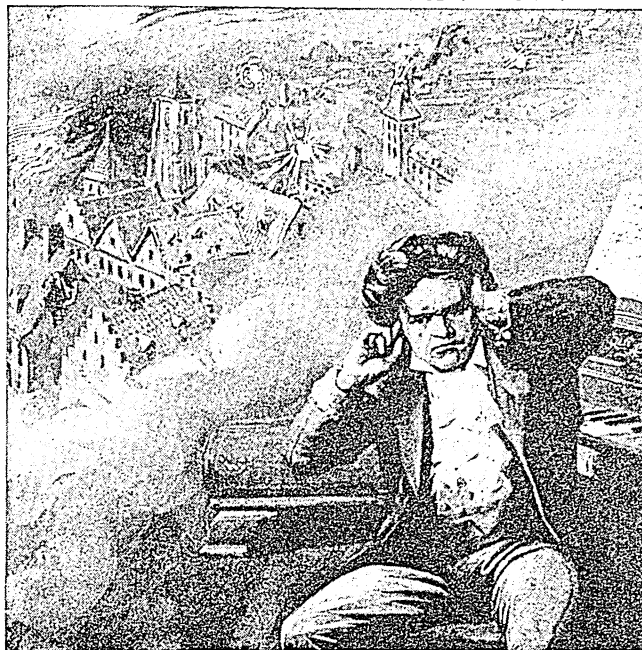
performance of his two greatest compositions, the total deafness of the great master made it necessary that he be turned to the audience to see the overwhelming storm of applause accorded him. It closes with a great funeral-pageant, in sad contrast to the death-bed scene in which the lonely artist passed away, his longing for intimate companionship unsatisfied.

Beethoven, while credited to the German nation, was of Dutch stock. His grandfather had removed his family from Antwerp to Bonn (Germany) 32 years before the birth of this famous musician.

Beethoven's family life was always miserable. The meagerness of the father's income as a singer and his intemperate habits kept the household always in need. The father planned to make of his son a child musician whose concert performances would fill the empty family purse. But with all his faults, the father must be credited with having given his son the best instruction he could procure for him. When 9 years old Ludwig was the pupil of the court organist of Bonn; when 11 he made his first concert tour; when 13 he became assistant court organist.

When Beethoven was but 15, the increasing incompetence of the father and the ill health of the mother made it necessary for him to take entire charge of the large family. In spite of these trying circumstances, the boy made such progress in his art that his friends, impressed by his genius, made it possible for him to take up his residence in Vienna, then the world's musical center, and the city in which he spent the remainder of his life. Here Beethoven's

BEETHOVEN AND THE THUNDER OF THE GUNS



Dread of the deafness which finally afflicted him overshadowed all Beethoven's life. During the siege of Vienna by Napoleon, he retreated to a cellar where he tried to shut out the sound of the guns lest they should destroy his hearing.

brilliant playing of the clavichord (a development of the clavier) at once established him in musical circles, and his compositions were eagerly sought by publishers. He soon became the foremost musician of the day.

Ears Deaf to the Music that He Made

These should have been bright years for Beethoven, but over all the glory of his success hung the dark shadow of a great grief. In the midst of his triumphs he became totally deaf. With this affliction came periods of intense suffering, caused by some acute digestive ailment and aggravated by his highly emotional temperament. At such times he was nervous and irritable and days of deep remorse followed. At last Beethoven entirely withdrew from society. His brothers attempted to manage his business affairs, entangled him in lawsuits, and estranged him from his best friends. A nephew who had been left in his care, and on whom Beethoven lavished all the affection of his lonely life, proved a burden of sorrow and bitterness.

His habits of living, like his music, knew no rules. When composing he could endure no interruption. He worked in the greatest disorder and oblivious to the passage of time. Unsympathetic housekeepers and landlords caused frequent quarrels and changes of residence. Beethoven never knew the comfort of a real home. He was fond of the country and spent much time in the fields, wandering about, singing and muttering to himself. Though below medium height, his friends say that in moments of inspiration

his diminutive figure seemed to tower to the gigantic proportion of his mind. A letter attached to his will begged that his doctor acquaint his friends with the physical conditions under which he struggled, that they might forgive his seeming harshness, which he declared was partially caused by his hopeless longing for human intercourse and sympathy.

And Yet How Splendid the Work He Did!

Pitiful as Beethoven's isolation was, it seemed a source of inspiration. Composition after composition flowed from his pen. All forms of vocal and instrumental music—from dainty bagatelle to grand symphony, from simple songs to opera, oratorio, and mass—are included in his works, 138 in number. In all these varied forms Beethoven proved his skilful musicianship. His 38 sonatas alone would give him a foremost rank among musicians; for he took this old set established form for all instrumental music and changed it, making it express a freedom of art unimagined by his predecessors. It is his symphonies, however, that make him incontestably preëminent. Richard Wagner, writing of these nine compositions, says: "He developed the symphony to such a fascinating fullness of form, and filled this form with such an unheard-of wealth of enchanting melody, that we stand today before the Beethoven symphonies as before the boundary line of an entirely new epoch in the history of art; for with them a phenomenon has appeared in the world, with which the art of no time and no nation has had anything even remotely to compare."



The ARMORED BANDITS of the INSECT WORLD

Protected Like the Knights of Old, These Doughty Fighters are Continually Engaged in a Ruthless Warfare. As Weight-Lifters, Wrestlers, and Acrobats They are the Olympic Champions of the Six-Legged Tribes

BEETLES. Few members of the insect world are better fitted for the rough and tumble of everyday life than those bold, blundering, hungry freebooters—the beetles. Nearly all of them are covered from head to foot with strong tough armor-plate, which is their skeleton worn on the outside. And in addition to this great advantage, they have drawn on nearly all the rest of Nature's bag of tricks for their protection and support.

Indeed, if a contest of strength and skill were held among insects, the beetles would undoubtedly carry off the prize for all-around excellence. There are powerful flyers, strong jumpers, fine climbers, and swift runners among them; some excel in digging and

boring, swimming and diving; and as weight-lifters, wrestlers, and acrobats, they number in their ranks the unquestioned champions of the six-legged tribes.

On the other hand, beetles are very poor singers, few of them possessing a voice at all, and most of those have only a feeble note. As if to make up for this, some of them, like the fireflies, have the extraordinary power of giving off bright light in the dark.

But it is the armor of the beetles that chiefly distinguishes them. As you know, it is a distinguishing trait of most of the insects to have four wings, like butterflies, moths, bees, wasps, etc. In the case of the house-fly and other true flies, the hind pair of wings has been lost. In the beetles, on the

THE BEETLE CIRCUS DOWN BY THE POND



Several distinguished members of the Beetle family have accepted the artist's invitation to show off their tricks. Two Wasps, who weren't asked to come at all, are flying around at the top, but you can't blame them, for that pair of tumble-bugs with their huge ball would make anyone stop and look. If they caught sight of that beetle just coming down the tree, they would rush away home, for that is the Wasp's-nest beetle, which lays its eggs near wasp holes and whose young devour the wasp grub. Walking up the tree is a Timberman and a larger long-horned Musk-beetle. At the foot of the tree a Hercules-beetle is watching a fierce group of Golden Ground beetles attacking an earthworm. Behind him is an Oil-beetle. Arriving on the wing at the extreme left is a Blister-beetle. Below the Blister-beetle appears a member of the scarab family, and beneath him the curious Caliper-beetle is just thrusting his head into the picture. The spotted fellow in the middle is the cruel Tiger-beetle on the lookout for prey. The big black Three-horned beetle is next, and below are the Rhinoceros-beetle and the Elephant-beetle. In the pond are two Diving-beetles, while a third has come out to try his wings.

other hand, something has happened to the front pair: they have turned hard and thick, folding down over the back and forming part of the creature's armor-plate. These front wings, or "wing-covers" as they are called, are not used for flying, but are raised on high to permit the filmy delicate hind wings to spread out when the beetle wants to take an air trip. Then when it alights again, the hind wings fold up, the armored wing-covers fall into place over them, and you would never know that the beetle was ever meant for anything except running, climbing, or swimming.

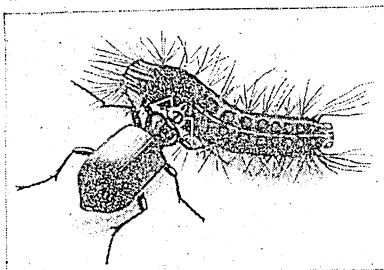
How the Beetles Got Their Name

It is from this peculiarity that the beetles get their scientific name *Coleoptera*, which means "sheath-winged." Another of their qualities is suggested by their English name, which comes from the Anglo-Saxon word *bitel*, meaning "the biting one." Most beetles are indeed great biters, having strong jaws which some use for killing living prey, some for devouring trees and plants, others for gnawing timber, leather, fur, cloth, books, etc., and others for tearing apart the dead things or refuse on which they feed.

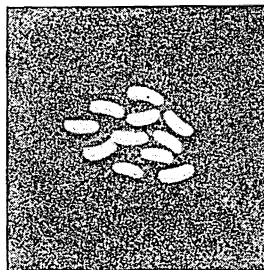
In battle, beetles are honest fighters using no stings or poison fangs, but grappling boldly "catch-as-catch-can" with jaws and claws. So, despite the fact that many beetles look fierce and dangerous, you may pick them up without fear, provided you dodge their "pincers" and don't mind the unpleasant smells many of them can create when frightened or angered. For this reason, and also because they are not easily injured by handling, beetles make the most interesting of insect "pets." If they are provided with their natural surroundings and their proper food, most of them quickly adjust themselves to life in a cage and show off their strange habits freely.

Because beetles have so admirably adjusted themselves to nearly all conditions of life, in nearly all parts of the world, the number of their species is believed to be greater than that of any other insect group, with the possible exception of the flies. Scientists have already classified more than 200,000 different kinds of beetles and more are added to the list every year.

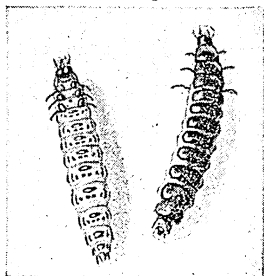
THE BEETLE AND THE GIPSY MOTH



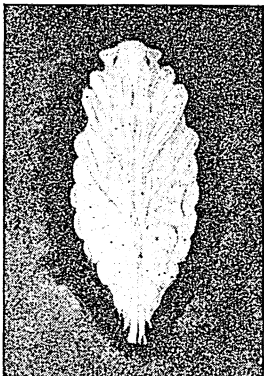
This is the *Calosoma* Beetle that was specially imported from Europe to help get rid of the Gipsy Moth. Here we see him about to dine on a Gipsy Moth caterpillar.



This is a group of the eggs of this beetle. They are buried in the ground. About a week later out come the young larvae, all ready to eat the young larvae of the Gipsy Moth.



These are the larvae of the beetle. Just as soon as they emerge from the ground they are able to climb trees and begin attacking the caterpillars that destroy our vegetation.



When full-fed the beetle larvae burrow into the earth and change to pupae, like this one. In a short time they assume the adult form and remain in the ground until the next season.

The life-cycle of all beetles has a complete metamorphosis, that is the beetle egg turns first into a grub or *larva*, then into a *pupa*, then into a full-grown insect (see Insects). Beetle larvae, which are usually soft-bodied and often wormlike, with hard heads and strong jaws, are usually very active and often more fierce and greedy than the grown-ups.

The smallest beetles are the "feather-wings," no larger than the head of a pin; the largest are the

African "goliaths" and the "elephant-beetles" of the West Indies, which reach six and seven inches in length and are the giants of the insect world. Between these two extremes are found beetles of all shapes and sizes, long and slim, short and fat, and with all the colors of the rainbow. Out of their immense number it will be possible to mention only a few of those which are remarkable for some trick or habit or some curious formation.

A Fierce Hungry Fellow

Perhaps the most interesting and handsome are the "tiger-beetles," wonderfully graceful and active insects with long slender legs for swift running, and colored with brilliant metallic greens and blues, sometimes marked with stripes or spots. They are fierce bloodthirsty creatures an inch or more in length, always on the lookout to pounce on some fellow insect and devour it. The tiger-beetle grubs have a strange way of trapping prey. They lie in holes in the ground, with their large ugly heads blocking the entrance. When an unwary insect steps upon its head, the grub drops suddenly to the bottom of the hole, and the victim tumbles after, to be seized and devoured.

But there's a much smaller beetle called the "bombardier," which has a way of making the hungry "tiger" look very foolish. Just as the latter's jaws are about to close upon it, the bombardier fires a little cloud of acrid irritating vapor from the rear of its abdomen. If once isn't enough to discourage the pursuer, the discharge may be repeated several times in succession, each accompanied by a faint "pop." Thus we see that "poison gas" in warfare is not so novel after all.

The Tumble-Bugs that Sleep with Kings

In contrast to the savage tiger-beetles are those peaceful, lumbering good-

LIFE HISTORY OF THE DEVIL'S COACH-HORSE

This fierce little creature belongs to the Rove-beetle family, distinguished by short wing covers, beneath which the wings are folded with amazing ingenuity. At the top the larva is burrowing in the ground and in the second picture it is enlarging its resting chamber. Next we see it transformed into a pupa, and lying beneath its cast skin. Then the pupa changes into the adult beetle, which crawls out and dries its new wings in the sun. Now it tucks its wings away under the wing-covers, and, in the sixth picture, turns its head quickly as it scents danger. As the enemy draws near, it tries to frighten it away by curling up its tail in the most threatening manner. This is pure bluff, for it has no weapons on its tail, and when the enemy—a bit of straw—comes close, it pounces upon it and seizes it in its jaws. The last picture shows the determined little fighter clinging like a bull-dog, when the straw is lifted.

natured members of the "scarab" family—perhaps the most famous of all the beetles, because their ancestors were held sacred by the ancient Egyptians, who buried them with their mummies and carved rare stones and gems in their likeness.

One of the scarabs, however, wears a clown's costume, and we call it a "tumble-bug" and a "dung-beetle." And a most interesting clown it is, too, as it carves out a mass of dung bigger than itself and rolls it into a perfect ball, then stands on its head with its hind legs up on the ball and pushes it along backwards. Up hill and down it goes, stumbling and kicking, crawling around and under its treasure, lifting it over stones, pulling it out of pits, until it finds a spot to suit it. There a hole is dug and into it the tumble-bug goes with its ball, remaining until it is entirely eaten. The eggs of the tumble-bug are laid in similar balls buried in the ground.

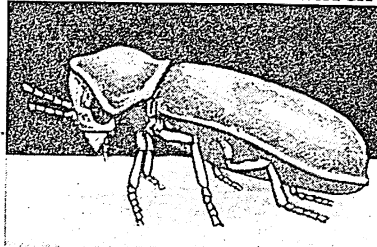
The "tumble-bug," like its cousin the "June-bug" (see June-Bug), and many other beetles, has a very hard time getting up if it falls on its back on a smooth

flat surface. There is a group of beetles, however, which has solved this difficulty admirably. They are the "click-beetles," so named because, if they are upset, they double up and then suddenly straighten out with a "click" which tosses them high into the air. Like cats, they usually land on their feet and scurry away. These acrobats are also called "skip-jacks" and "snapping-bugs." Their larvae are the "wire-worms" so destructive to farm and garden crops and fruit trees.

On the whole, the order of beetles is very harmful, for although the tiger-beetles, the ground-beetles, the lady-bugs (see Lady-Bug), and many other varieties destroy enormous numbers of plant-eating insects, and the scavenger and carrion-beetles dispose of a great quantity of decaying matter, there are far more beetles which feed upon trees, plants, fruit, grain, and other valuable foodstuffs. Among the worst offenders are the rose-chafers, the leaf-chafers, nearly all of the long-horned beetles, the dreaded potato-bugs, the tortoise-beetles, the darkling-beetles, the asparagus-beetles, the Japanese beetles, those enemies of timber the engraver-beetles, and, most destructive of all, the countless hordes of snout-beetles or weevils (see Potato-Bug; Weevils).

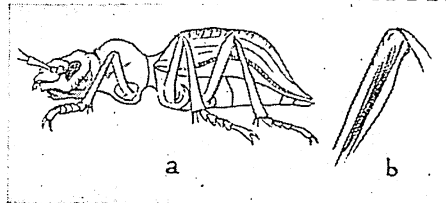
It has been said that there is no animal or vegetable substance that is not preyed upon by some member of the beetle family. As an example of varied diet

THE RAP OF THE DEATH-WATCH



The Death-Watch, instead of trying to frighten people, when he makes that dreaded rap, is signaling to his lady love. Here we see this beetle much magnified, raising his head, and then bringing it down with a thud.

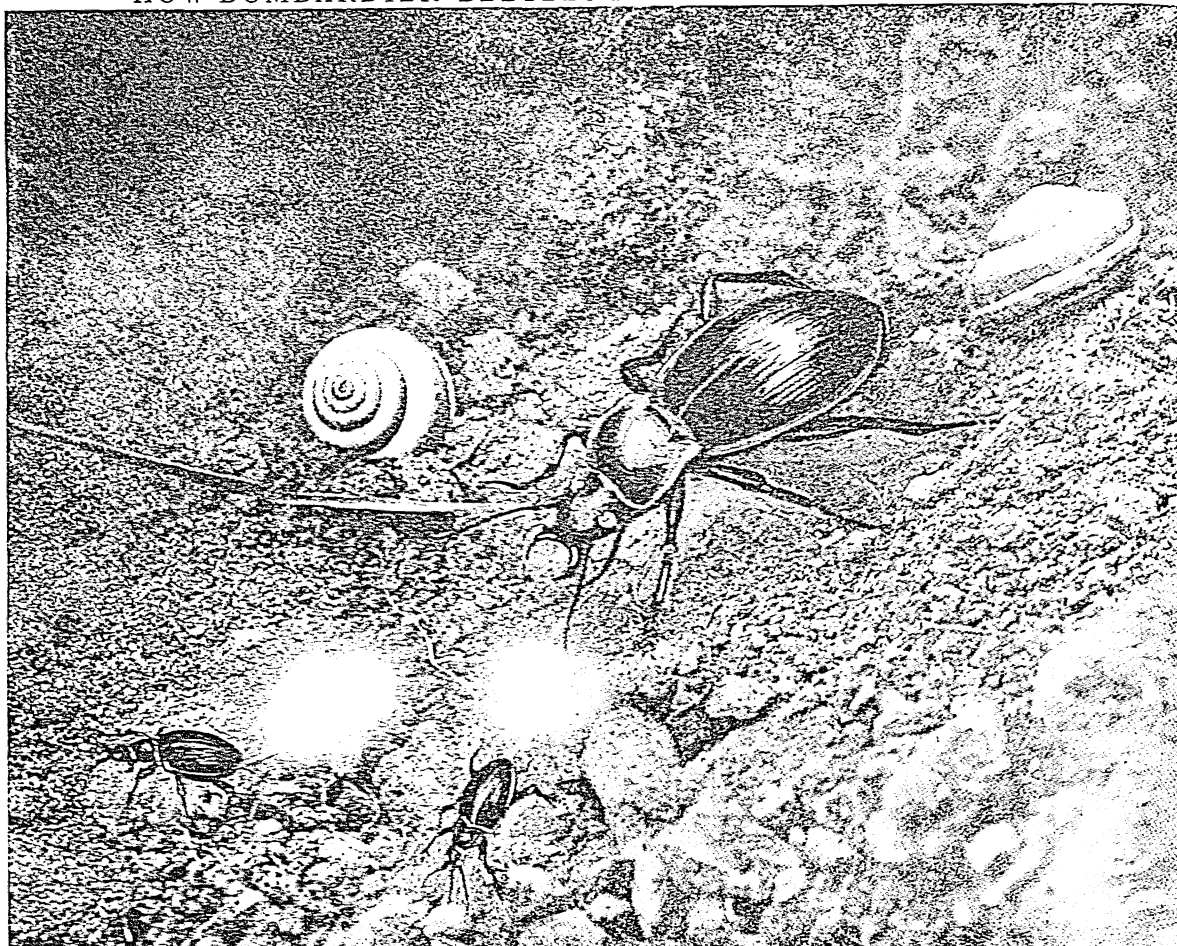
THIS BEETLE PLAYS A FIDDLE



Some Leaf-beetles make sounds by rubbing the row of fine ridges on their wing-covers (a) with another ridged surface on the inside of their hind legs (b).

consider the menu of the tiny "drug-store beetle," which not only eats any form of dry groceries, but delights in such things as red pepper and in at least 45 different drugs, including aconite, belladonna, and

HOW BOMBARDIER-BEETLES REPEL THEIR HUNGRY FOES



This scene—a photograph of a museum group—shows a Tiger-beetle pursuing two Bombardier-beetles. The smaller insects are armed (as their name implies) to defend themselves against the assault of their enemy. When they are attacked, they “bombard” him by ejecting a foul-smelling and irritating gas. This discharge is accompanied by a popping sound. It can be repeated several times in rapid succession, and so the Bombardier-beetles usually succeed in driving off attackers.

ergot—all three poisonous to man. Printed books are not too dry for it nor paraffin too oily. A near relative, the “spider-beetle,” one of the varieties often called “bookworms,” has a record of having “penetrated directly through 27 large volumes in so straight a line that a string could be passed through the opening and the whole series of volumes suspended.” Another relative, the “cigar-beetle,” dines on cigars, cigarettes, and any form of dried tobacco.

The “Death-Watch” and His Mysterious Tick

It is to this group of small beetles that the famous “death-watch” belongs. Spending its life in tunnels bored in furniture or other household timber, this creature calls to its mate by tapping its head against the sides of its corridors. This faint knocking sound was formerly believed to be a warning of impending death.

Other pests are the *dermestids* or “skin-devouring” beetles, including the “larder-beetle,” which feeds on smoked meats, hides, feathers, hair, and horn; the “leather-beetle” of similar tastes; the “carpet-beetle”

or “buffalo moth,” which is not a moth at all, but one of the worst foes of carpets and stuffed animals and other museum specimens.

One of the strangest of beetles is the “blister-beetle,” sometimes called the “Spanish fly,” for besides the fact that its body contains a substance which is used medicinally for raising blisters on the human skin, it has a most unusual life history. After the larva hatches from the egg, it does not go directly into the pupa form, but passes first through no less than five intermediate larval stages. The wingless “oil-beetles” have a similar experience, which is called by scientists *hypermetamorphosis*.

The Pirates of the Pond

Among the most interesting water-beetles are the large predacious diving beetles, so called because of their fierce and bloodthirsty disposition. Shaped like huge watermelon seeds, their smooth boat-shaped lines and paddle-shaped hind legs make them excellent swimmers, enabling them to capture and devour almost all of the smaller inhabitants of ponds, includ-

ing young fish. When at rest they float head down with the tips of their bodies sticking out of the water. In this way their *spiracles* or breathing tubes, situated at the rear of the abdomen, have access to the air. When they dive they carry down a supply of air beneath their water-tight wing-covers. Their larvae, known as "water-tigers," are even fiercer and hungrier creatures than the adults.

The "water-scavenger" beetles, sometimes one and a half inches long, may also be found in quiet pools, where they clean up decaying plant and animal matter. They carry the air they need for breathing in a thin film spread over the under side of their body, which gives them a silvery appearance when seen from beneath. Unlike the diving beetles they are highly desirable pets for an aquarium, for they keep it clean without molesting the other inmates.

The Funniest Beetles of All

The most amusing of the water-beetles are the "whirligigs," which may be seen on any body of still water dancing in rapid circles over the surface, as though gone mad. If disturbed, they make a queer squeak by rubbing the tip of their abdomen against their wing-covers. These whirligigs have split eyes, the upper half for seeing objects above the surface, the lower half for looking through the water.

A strange family of creatures called "stylops" is sometimes included in the beetle order. Only the male has wings; the female spends her entire life in the body of some other insect such as a wasp, the tip of her body projecting through the segments of her host's abdomen.

No dragons ever invented to frighten children could be stranger in appearance than the monsters of the beetle tribe. The "stag-beetle" with its great hooked mandibles, nearly as long as the insect itself, is perhaps the most startling of northern species, but the tropics have even more remarkable species, such as the "centaur-beetle" with its huge cow-like horns; the five-horned "rhinoceros-beetle"; the "hercules-beetle" with the long wicked-looking projections from its head and back used by the male in carrying its mate; and many others. Curiously enough, these freaks are nearly all the most harmless of all the beetles.

Beetles are not True Bugs

Though many beetles are popularly called "bugs," they should not be confused with the true bugs with sucking beaks, which form a distinct order of insects.

In addition to the hard wing-covers (*elytra*) which distinguish beetles from other insects, they have the first segment of the thorax, the *prothorax*, movable. To this is attached the first pair of legs, the other two pairs being fastened to the second and third segments. In certain of the running beetles the hind wings are reduced to a very small size, useless for flight, or are absent altogether, and in such cases the edges of the wing-covers are often grown together. In other species, such as the "rove-beetles," the wing-covers reach only a short way down the back, leaving the

rear of the abdomen exposed. Beetles' eyes are of the large compound variety; the simple eyes or *ocelli* being very rare among adults, even when existing in the larvae. The *antennae* or feelers are of widely various forms, sometimes broad and short, sometimes twice as long as the beetle's body. They are organs not only of touch, but of smell, and probably of hearing.

Scientific names of best-known beetle families: ground-beetles, *Carabidae*; tiger-beetles, *Cicindelidae*; carrion-beetles, *Silphidae*; rove-beetles, *Staphylinidae*; glowworms, etc., *Lampyridae*; click-beetles, *Elateridae*; water-beetles, *Hydrophilidae*; oil-beetles and blister-beetles, *Meloidae*; stag-beetles, *Lucanidae*; scarab-beetles, *Scarabaeidae*; ladybugs, *Coccinellidae*; weevils, *Curculionidae*.

BEGONIA. This common house plant is cultivated for the beauty of both flowers and foliage. It is easily grown from cuttings taken in the late summer and autumn. The flowers are usually large and showy, some greenhouse varieties reaching four to six inches in length, and vary in color from pink to scarlet and from white to yellow. The fleshy waxy leaves vary considerably, some being large, smooth, and variegated, some hairy and red-tinged. Winged fruit capsules contain minute seeds. The summer-flowering begonia, which produces large single and double flowers, is tuberous rooted, while the winter-flowering variety is fibrous rooted. Two other species are the semi-tuberous begonia, with peltate leaves, and an Asiatic variety, *Begonia rex*, with striking foliage.

The begonia is native to the tropics of both hemispheres, excepting Australia. In North America, it is at its best when grown indoors. Of the 750 species, 150 are cultivated for ornamental use. The flower was named in honor of Michel Begon (1638-1710), a French naval officer and a noted patron of botany. **BELFAST, NORTHERN IRELAND.** The capital and largest city of Northern Ireland and the busiest port in all Ireland, Belfast is situated on the Belfast Lough, a bay of the Irish Sea. It has a large shipbuilding industry, dating from late in the 18th century; and it is the center for the manufacture of fine linens, for which Ireland is famous. Among other important products are textile machinery, clothing, tobacco, rope, beverages, soap, and biscuits. Its trade is carried on chiefly with Liverpool, Glasgow, and other ports of the British Isles.

The people of Belfast are chiefly descendants of Scottish and English colonists of the 17th century. Their faith is overwhelmingly Protestant. The city therefore became the center of opposition to Home Rule and to the Irish independence movement, through fear of religious and economic oppression by the agricultural and Catholic majority of the island.

In appearance Belfast is modern. In the 16th century there was only a little fishing village on the site, and not until the introduction of machine spinning and weaving in the latter part of the 18th century did it begin to thrive. It is the seat of Queen's University and an allied college of technology. Population, about 440,000.



BRAVE *and* THRIFTY BELGIUM

*The Story of Its Desperate
Struggle Between the Warring
Nations and the Hungry Sea*

BELGIUM. A triangular-shaped land,—with the long side lying along the French border; the base resting against Luxemburg, Germany, and the “panhandle” of Dutch Limburg; and the third side bordering on the shallow North Sea and the kingdom of the Netherlands (Holland)—such is the little kingdom of Belgium, a land which has probably played as important a part in the world’s affairs, in proportion to its size, as any other country since the days of ancient Greece and Rome. During every one of the centuries which intervene since the Roman conquest, Belgium has been one of the battlegrounds of Europe. And the struggle has been not only with hostile man, but with unfriendly Nature as well. Like the fields of Holland, those of Belgium are in part the product of careful fertilization of barren sand-dunes; and dikes and windmills are still necessary to prevent constant encroachments of the hungry sea.

In this struggle with Nature the Belgians have succeeded wonderfully well. Today we find, fringing the sea, only a narrow belt of dunes whose shifting sands are overcast with clouds and enveloped in mist. Behind this bleak region lies a verdant garden in which nestle the red-roofed cottages of the peasants.

WHAT dreadful scenes of carnage have been enacted “in Flanders’ fields,” ever since those ancient days when Caesar first wrote of the bravery of the Belgae! Romans, Franks, and Northmen pass bloodily over the land. Sturdy Flemish burghers withstand their feudal count in the tumults of the Hundred Years’ War. Two hundred years later Belgium groans beneath the tyranny and massacres of Spanish Philip II and his agent, the Duke of Alva. The English Marlborough and the Austrian Prince Eugene here successfully resist Louis XIV’s attempt to annex the rich provinces to France. Again Belgium is the cockpit of Europe when Napoleon is overthrown at Waterloo. In 1914–1918 betrayed Belgium is overrun and plundered by the Germans. In 1940, hardly recovered from the last war, it is again invaded by Nazi Germany. And then—its cities bombed, its factories wrecked, its young men lying unburied on the battlefields—it passes once again under the shadow of German occupation.

The green fields, watered by running streams and sluggish canals, are rich with harvests of wheat and rye. In some of the fields, men in coarse smocks, with their loose baggy trousers tied below the knee with a cord, are spading the ground. In others men and women kneel and patiently weed the flax; while in the streams they beat the ripened stalks to separate the fibers so that they can be spun into

linen thread. Every foot of ground is made to produce the utmost possible, and grain and sugar beets are largely cultivated. But even so Belgium is not able to supply food enough for all her people; for while its area is about equal to that of Maryland, its population is five times as large, making it one of the most densely peopled lands in Europe. There are a score of thriving cities, and a hundred little villages dot the fields; along the banks of the poplar-lined canals the peaked roofs of the cottages form an almost unbroken line, and on every side rise the innumerable towers and spires of the churches. Belgium, indeed, is richer in these monuments of medieval architecture than any other country except northern France.

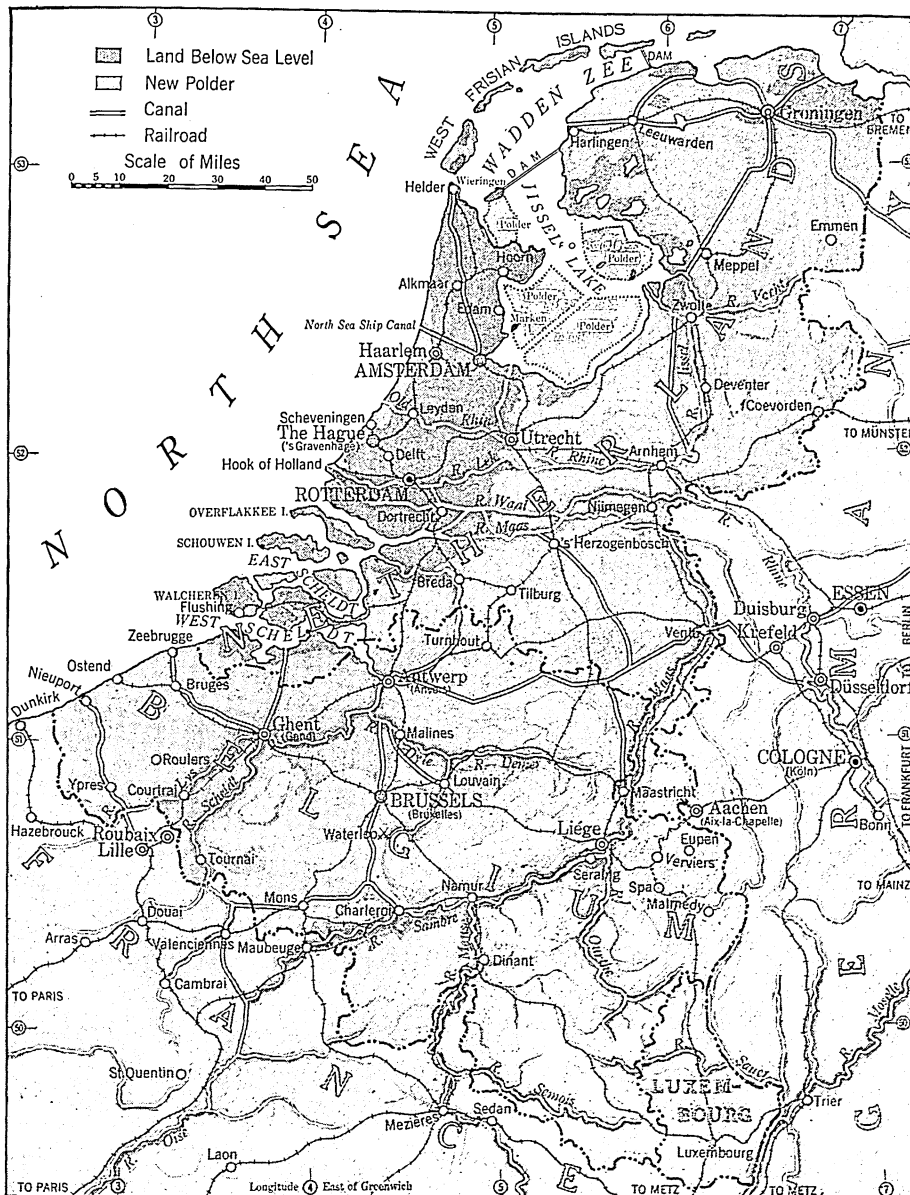
Europe’s Greatest Mart

In the 14th and 15th centuries Flanders—as western Belgium was then called—was the richest part of

Europe. The rivers, the Scheldt, the Meuse, the Yser, and the Zwyn, were choked with fleets from all parts of the known world. The wharves of Ghent were piled with bales of wool from England and with casks of wine from southern France. The vast cloth hall of Ypres was crowded with eager merchants struggling

Much of the money gained from this commerce was used in building churches, but more was used in the construction of their town-halls and belfries. The people were jealous of the glories of their towns. No one spoke of being a citizen of Flanders, but he was a man of Bruges, of Ghent, or of Ypres, as the case might be.

THE HEART OF INDUSTRIAL EUROPE



Upon its rich coal and iron mines, located chiefly in the rugged region of the southeast, little Belgium built an industrial economy that was virtually unequaled in Europe. Concentrating on its industry and importing much of its food, Belgium managed to support an unusually large population for its size. To the north the land slopes in a low plain toward the sea. This northern plain, along with the river valleys of the south, provided an ideal route into France for German armies in 1914 and again in 1940.

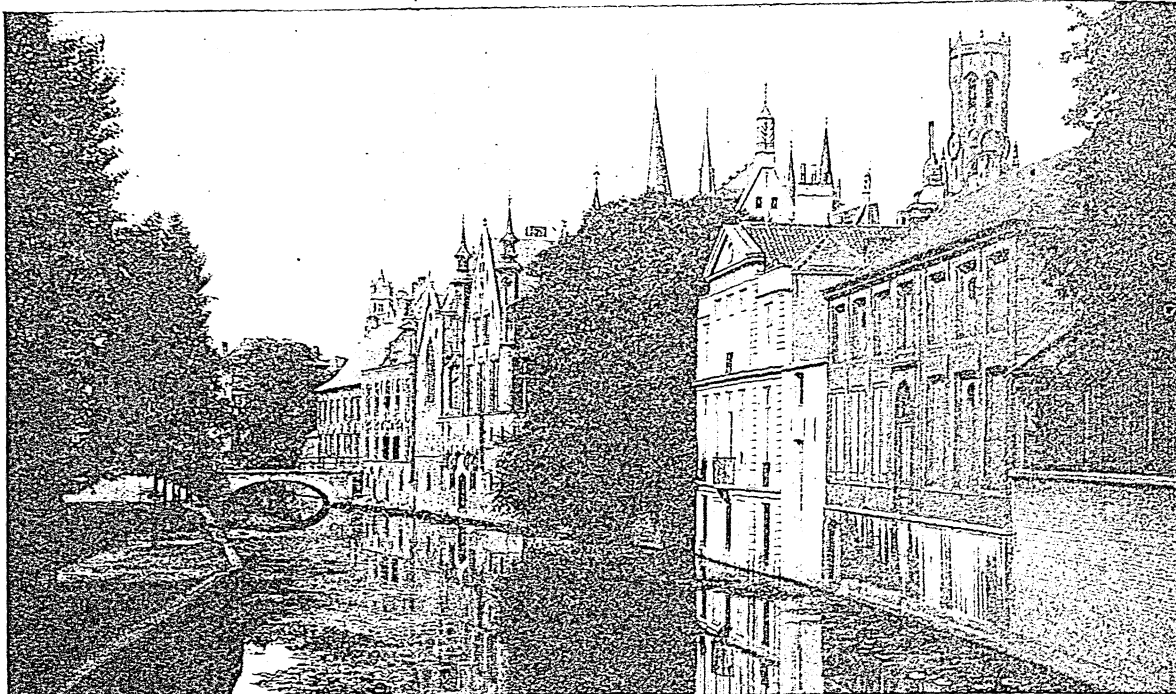
for the products of the Flemish looms and the handiwork of the patient lacemakers. And it is said that merchants from 17 kingdoms had settled homes in Bruges, the great northern market of Europe.

the sea, and the inhabitants of the city say that "the whole world is a ring, in which Antwerp is the diamond." South of Antwerp lies Brussels, the well-built modern capital of the kingdom. Down

One of the fascinating stories of history is that of the struggle of these cities to gain more privileges from their counts and dukes. One of their demands was for the right to build a belfry, from which the curfew (*couvre feu*, "cover fire") should ring each night, and the alarm bell when the town was threatened by fire or by hostile attack. Many a time during the 14th, 15th, and 16th centuries did these towns call the burghers to arms; for the cities were forced to defend their rights alike against the kings of France, the dukes of Burgundy, the kings of Spain, and the Holy Roman emperors. Before the long struggle was over much of their commerce was ruined and these formerly busy marts had lost their independence and political importance, but not their picturesque charm.

The present-day gateway to this garden-land of Europe is Antwerp, which in the 15th century wrested from Bruges its commercial supremacy. It lies on the winding course of the Scheldt River, 50 miles from

BRUGES, THE "CITY OF BRIDGES"



Here is a typical view of this ancient city, the smooth waters of whose canals reflect solid old buildings and pleasant parkways. The name Bruges comes from the old German for "bridge," given to it because of the many bridges over its canals. On these canals are seen many stately swans, maintained by the city in expiation of a crime committed during a medieval revolt, the killing of a magistrate, who had a swan on his coat-of-arms.

its streets clatter the Flemish milkmaids in their wooden shoes and their huge white caps and their large gold earrings. Rough good-natured dogs draw little carts filled with shining brass and copper milk-cans. From the houses comes the hum of looms, for although Belgium has many large textile factories, much of the work is still done at home. In Brussels hundreds of women sit all day long patiently weaving in and out the threads of fine Brussels point-lace. For more than 400 years the country has been famous for its lace manufacture, not only of Brussels lace, but also of the airy Mechlin lace and the fine Valenciennes. The well-known Brussels

carpets are not made in Brussels, but at Tournai, a busy town on the Scheldt, some 50 miles away to the southwest. Everyone, everywhere, seems to be busy—

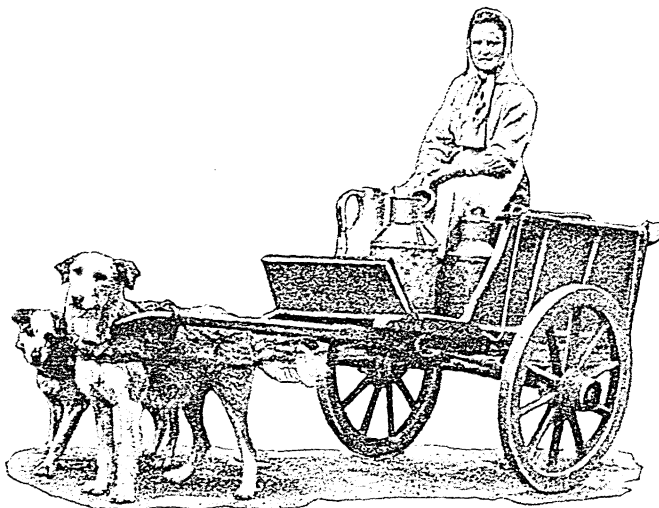
except at Ostend. This is the great seaside resort, and one of the playgrounds of all Europe. But even Ostend has its industrious side, for it is the second port

in the kingdom, connected by canal with the quaint old cities of Bruges and Ghent, and is the center of the Belgian fishing and oyster industry. Magnificent cathedrals, gild halls, and ancient fortresses remind the traveler of the medieval glory of these cities.

To the southeast of Brussels the skies at night are aflame with the glare of the iron furnaces and the glass and other factories at Liège. This is one of the busiest parts of the great workshop of Europe, because of the gifts which Nature has lavished upon this section.

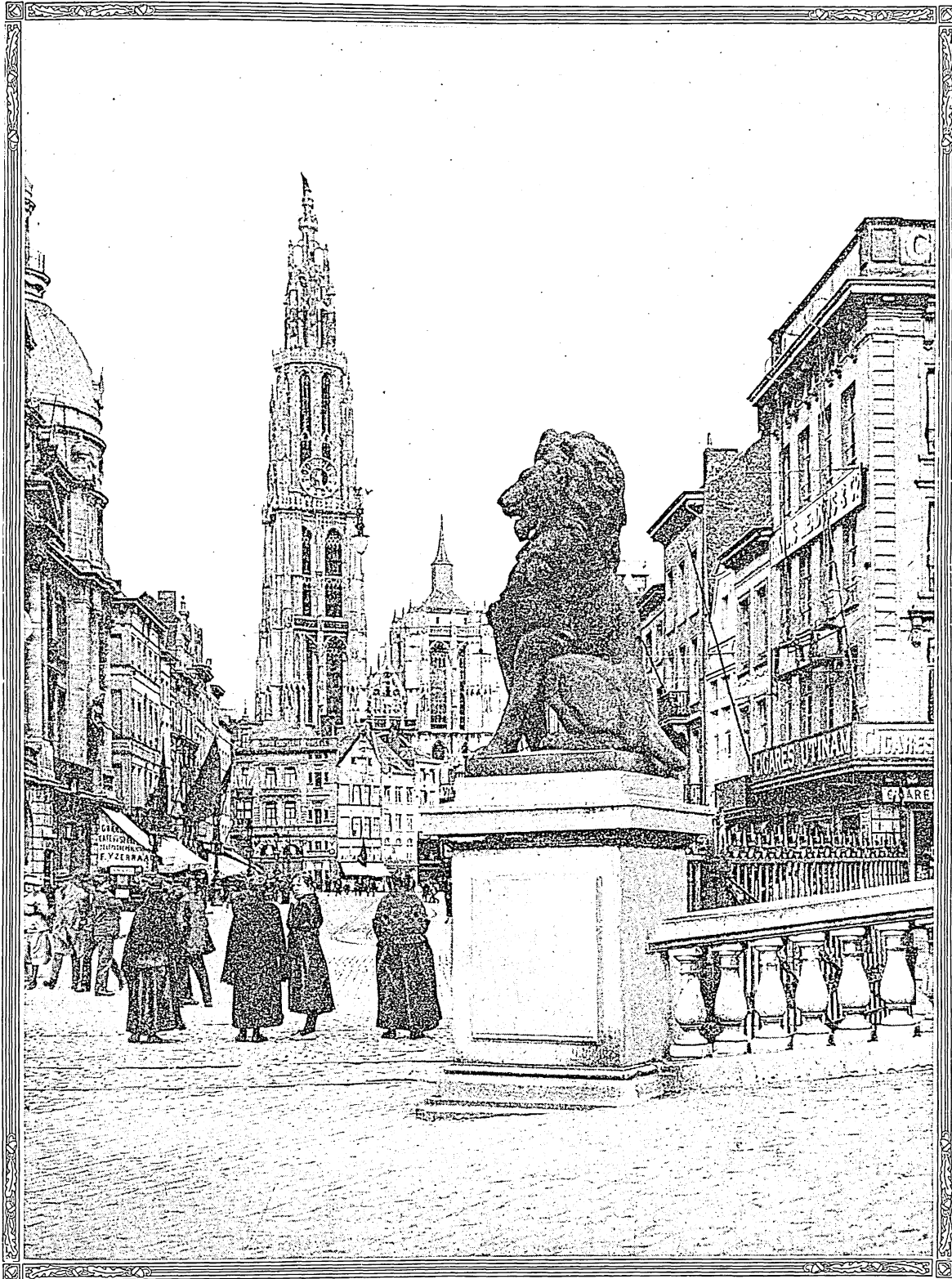
Indeed, it is Belgium's rich mines of coal and iron—supplemented by the near-by iron ores of Luxemburg and northern France—which make her

THE DOGS THAT BRING THE MILK



In Belgium you don't watch for the milkman, you watch for the milkmaid with her dog-cart. The milk is brought in cans of copper and brass, from which it is dipped out into your own jug.

IN THE HEART OF OLD ANTWERP



This picturesque city, one of the greatest seaports in the world, has a history reaching back to the days of the Northmen. We are here in the center of the oldest part of the city, where stands the cathedral, the largest and most beautiful Gothic church in the Low Countries. In the foreground stands a figure of the Lion of Belgium. Many of the buildings in this quarter are the ancient guild houses of medieval days. These contrast strangely with the modern structures in the right foreground.

an industrial country. Even the sand of her dunes is made use of in the thriving glass manufactures. But though rich in natural resources, this region is poor in beauty. The earth is scarred and disfigured by the refuse from the mines. The villages, stretching over a gray country, are lost behind mountains of coal ash, or they crouch beside the towering chimneys of huge factories. South of this "black country" lie the somber woods and the swift-flowing rivers of the Ardennes hills, which in places are 2,000 feet high. The wild boar still lives in these protected forests, much as it did more than 1,100 years ago when Charlemagne hunted through this wooded region.

Problem of Race

Belgium's oldest problem is the division of the country into two sections different in race and language. In the northern half, the people speak Flemish, a tongue closely akin to Dutch, and cling to Flemish traditions. In the southern part, French is spoken and French culture prevails.

The origin of this conflict between the Flemish of the north and the Walloons of the south goes back to the first century B.C., when Caesar conquered Gaul and the territory was completely Romanized. Four centuries later the northern part of the country was invaded and profoundly influenced by the Franks, the Germanic ancestors of the Flemings, while the southern half remained Gallic-Roman.

From the Middle Ages to the Present

After its period of medieval prosperity, Belgium suffered severely when the land was handed about from one country to another—when the dukes of Burgundy sought to repress the free spirit of the towns; when Philip II of Spain drenched the land with blood; and when Austria, after obtaining these provinces by the Treaty of Utrecht (1713), tried to crush the liberties of the people. The country was annexed to France at the time of the French Revolution, but handed over to Holland as part of the Kingdom of the Netherlands in 1815.

Not until 1830 did the Kingdom of Belgium come into existence. As a liberal, constitutional monarchy, whose independence and neutrality were guaranteed by all the powers (1839), Belgium then entered on a period of rapid progress. It profited enormously from the rich Belgian Congo, a territory 80 times as large as Belgium itself, which King Leo-

pold II, who had held it as a private possession, turned over to the nation as a colony in 1908 (see Congo State).

The occupation of Belgium by the German army from 1914 to 1918 devastated the country, crippled its industries, and inflicted great privation on the people (see World War of 1914-1918). Those who remained in the country were kept alive largely by the efforts of Herbert Hoover as head of the Commission for Relief in Belgium, and by loans from the American government totaling \$180,000,000.

At the conclusion of the war, the three major parties—Socialists, Liberals, and Clericals—united for the enormous task of repairing the ravages of the German occupation. This period of reconstruction was marked by much liberal legislation. In 1934 Belgium's beloved King Albert died and was succeeded by his son Leopold III (see Albert I, King of the Belgians).

King Leopold in 1937 severed all of Belgium's military alliances. Great Britain, France, and Germany promptly guaranteed that they would respect Belgium's neutrality and independence. When Europe was plunged into war in September 1939, Belgium remained rigorously neutral.

The long-feared attack by Germany came on May 10, 1940, when Belgium, along with the Netherlands and Luxem-

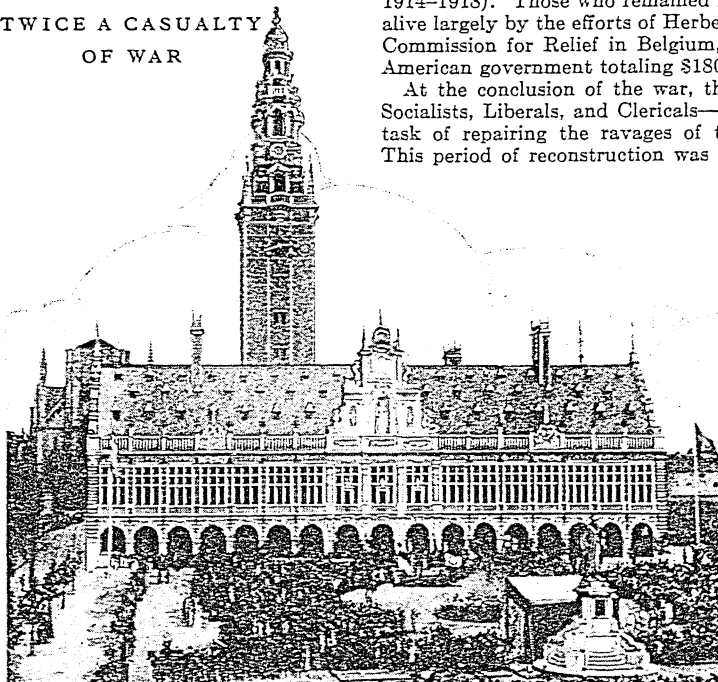
burg, was invaded by the Nazis. British and French troops aided the Belgians, but they were unable to halt the crushing German advance. On May 28 King Leopold surrendered the Belgian army. Shortly thereafter Allied troops were evacuated, leaving the Germans in complete possession. A Belgian "government in exile," supported by the government of the Congo State, repudiated the King's capitulation. Area, 11,754 square miles; population, more than 8,000,000. (For Reference-Outline, see Netherlands; see also World War, Second; and Belgium in FACT-INDEX at the end of this volume.)

BELGRADE (*běł-grād'*), YUGOSLAVIA. East meets West in Belgrade (Serbian *Beograd*), the capital of Yugoslavia. Alongside modern office buildings, luxurious hotels, and fashionable cafés are tumble-down Turkish shops and cobblestone streets, where men and women in the latest Parisian clothes rub elbows with peasants in native garb.

This Balkan city of contrasts, with about 242,000 inhabitants, occupies a dominating situation on a ridge at the junction of the Danube and Sava rivers. On a chalk cliff at the apex, overlooking the broad blue lake formed by the meeting of the rivers, stood the once white walls and towers of the ancient citadel, formerly an important fortress. It is from this citadel that Belgrade got its name, which means "white castle."

The city has excellent rail and river transportation and is a center of trade between central Europe and the Balkans. Among its industrial establishments

TWICE A CASUALTY OF WAR



This library of the University of Louvain, with its priceless collection of books and manuscripts, was destroyed by the Germans in 1914. Rebuilt largely by gifts from Americans, the library and its some 700,000 volumes were again reduced to ashes during the German campaign in Belgium in the spring of 1940.

are breweries, textile mills, potteries, iron foundries, and canneries; but the total output of manufactured goods is still of slight importance.

Few cities have seen more battles, plots, and crimes than Belgrade. As early as the 3rd century B.C. it was a fortified post. The Turks called it the "home of wars for the faith," because before its walls they fought for a passageway for their rule and the Moham-medan religion into central Europe. As the key to Hungary and the gateway to Serbia, it was coveted by both Christians and Turks, and changed

masters again and again. Although Serbia was freed from direct Turkish rule in 1829, the Turkish garrison was not withdrawn from Belgrade until 1867. During the World War of 1914-18 Austrian troops captured the city and held it for three years. In 1941 war with Germany brought ruinous aerial bombardment and occupation by German forces.

BELL. From the early centuries of the Christian era the ringing of bells has been used to mark the divisions of the day, to summon the faithful to prayer, and to announce tidings of joy or sorrow. They have sounded the alarm of fire and the tocsin of war, and have given the signal for many a deed of terror.

Voices of History

When the armistice that ended the World War of 1914-1918 was signed, thousands of church bells throughout the United States and the other victorious nations pealed out the glad tidings. Some of the English bells that were set swinging on that day are so ancient that they may have been used to celebrate every notable event in English history, from the signing of the Magna Carta in 1215, and have tolled the passing of every ruler of England since the death of John Lackland.

At Eastertide in 1282 the vesper bells of Messina marked the beginning of one of the most atrocious massacres in history, which

has ever since been known as the "Sicilian vespers." And on Saint Bartholomew's Day in 1572, church bells gave the signal for the massacre of thousands of Huguenots in France.

In the days of ancient Greece and Rome bells of this sort were unknown. The only bells the ancients had were small handbells, often shaped like the square-mouthed bells we tie to the necks of sheep and cattle, or they were closed bells like our sleigh-bells. Such small bells were hung about the necks of dogs

and cattle, and small tinkling bells of gold were attached to the dress of high-priests of the Hebrews.

The First Church Bells

By the 5th or 6th centuries of our era, when Christianity had firmly established itself in the Roman Empire, bells were in use in Christian churches. At first they were of small size, but gradually they became larger, and were placed in high towers so that they could be heard throughout the city. Sometimes these towers were built as a part of the church; but often they were separate structures, especially in Italy, where the bell-towers or *campaniles* (from the Latin word *campana* meaning "bell") developed into structures of extraordinary beauty. Among the most famous and beautiful of existing bell-towers are the campanile of Saint Mark's at Venice, which collapsed in 1902 after standing a thousand years, and was rebuilt in 1912; the leaning tower of Pisa; and Giotto's campanile at Florence. The beautiful tower form developed by the builders of the Middle Ages has been copied by modern architects for the towers of some of our great sky-scrapers.

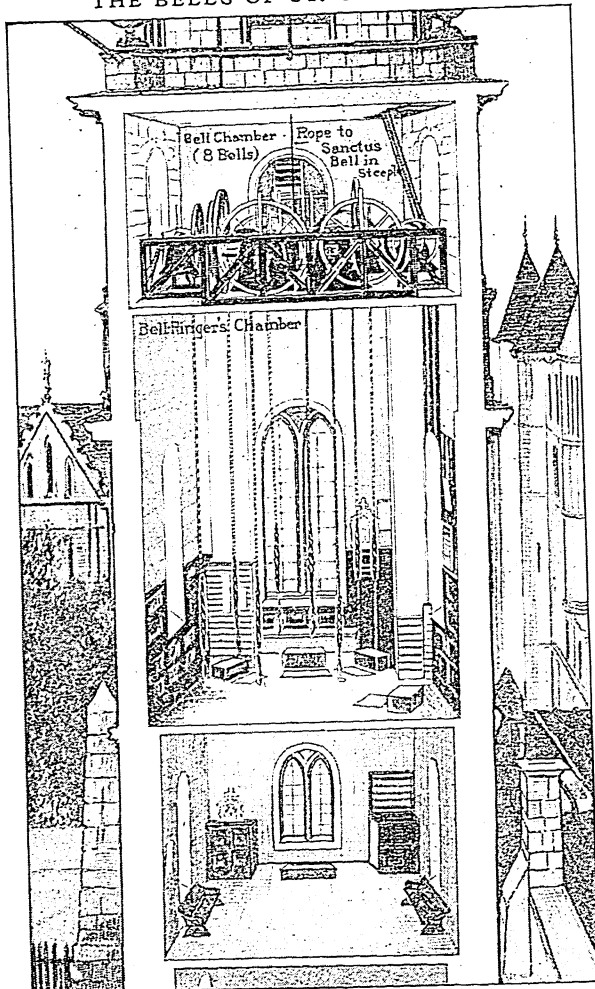
The earliest bells preserved in the British Isles, like the famous Saint Patrick's bell at Belfast, which is supposed to date from the 6th century, were of the ancient rectangular shape, and they were made of thin plates of metal riveted



No skilled performer on the piano or any other musical instrument ever took more pride in his work than did the old bell-ringers of England, such as Dickens has immortalized in his story of 'The Chimes'. You see how this old gentleman operates three bells by using his foot as well as his hands. Bell-ringing is still an accomplishment in rural England.

together. Gradually men learned the art of casting bells in one piece, and worked out the familiar curving bell-shape which produces the most brilliant tone and the longest vibrations.

THE BELLS OF ST. CLEMENT'S



Here is a view inside the tower of the famous bells of St. Clement's in London. Eight of the bells are attached to those wheels you see in the upper room, while the ninth, the Sanctus bell, is lodged in the steeple.

The process of casting bells is much the same today as it was many centuries ago. A core of bricks is built up and covered with soft clay, molded to the outline of the inside of the bell. Then an outer mold or "cope" of clay is made, shaped to the outline of the outer surface of the bell, and the molten metal is poured in and left to harden. When the molds are removed the bell may be tuned to the desired tone by taking off thin shavings from the inside.

Metals Used for Bells

From the earliest times—as far back as the days of Nineveh—the metal most used was an alloy of copper and tin in various proportions (*see Alloys*). Iron and steel were occasionally used, but bells so made are much inferior in tone.

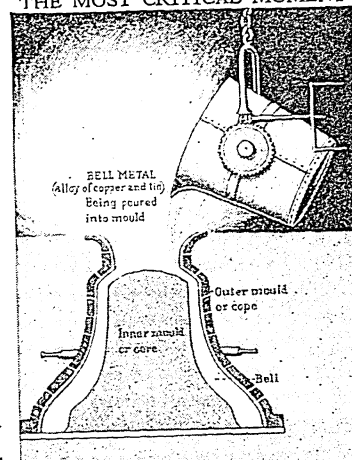
It has long been customary to hang several bells of different pitch together, which are made to sound one after the other and thus play simple tunes; these are called a "peal" of bells, or "chimes." Each bell was rung by pulling a separate rope. As the number of bells increased from 3 to 8, or even 12, an elaborate art of bell-ringing was developed. With three bells, only six "changes," or sequences, are possible, while eight bells give the enormous number of 40,320 changes. With 12 bells the number is so great that it has been calculated that to ring the changes at the rate of two strokes to the second would require 91 years. Bell-ringing became a fascinating popular amusement in England in the 17th century. Societies were formed all over the kingdom which performed wonderful feats of accuracy and endurance in competition. The patterns or tunes were worked out by experts and received many queer names, such as "Kent treble bob major," "Grand-sire Triples," "Treble bob royal." The art of bell-ringing is still practiced with enthusiasm in rural England.

In the United States and the Continental countries, especially Belgium, chiming is usually done by mechanical devices. Sometimes as many as 60 or 70 bells are thus played by means of a keyboard or levers, so that any tune may be played with its accompanying harmonies. In "ringing," properly so called, the bells are swung through a complete revolution, resting bottom-upward at the end of each swing. "Chiming" is the technical term for swinging the bells in their normal position just far enough to be struck by the clapper, or for producing tones by striking the stationary bells with small hammers. The latter method is used in all mechanically operated chimes or carillons. These carillons are sometimes played by means of a cylinder, just like a barrel-organ, which is set off at regular intervals by clockwork or by turning a crank by hand.

In this country bells are customarily used only for striking the hours, for fire-alarms, for special celebra-

tions, and for announcing religious services. In the older nations many of the ancient uses still survive. The bell in the parish church sounds the rising signal at five or six o'clock, indicates the time for dinner, and sounds the curfew or retiring signal at eight or nine.

THE MOST CRITICAL MOMENT



Casting a bell is a very difficult art, for the slightest flaw, such as an air bubble or a tiny crack that comes as the metal cools, may ruin its musical note.

THE LARGEST BELL IN THE WORLD

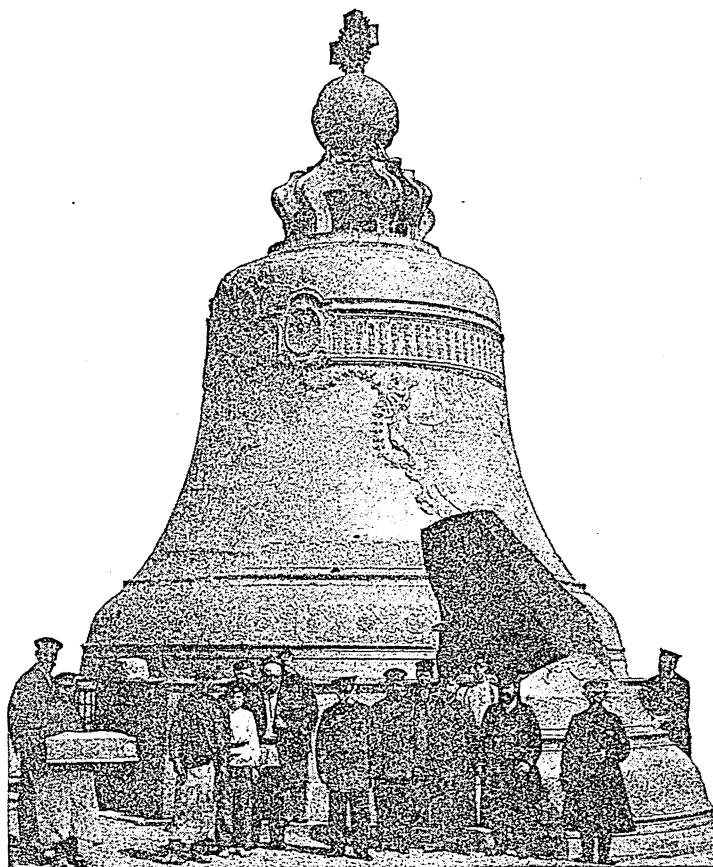
The curfew (from the French *couvre feu*, "cover fire") has rung in many parts of England every night since the time of William the Conqueror. In many places in the United States it has been introduced as a signal—say at nine o'clock—when children unaccompanied by adults must leave the streets and go home. At Oxford University, 101 strokes are rung on "Great Tom" in Christ Church College at nine o'clock every evening to warn the undergraduates to return to their colleges.

Smaller bells of various shapes are used for an infinite variety of purposes—attached to clocks to sound the hours or to waken us in the morning, to summon us to the telephone or

announce the presence of a visitor at the door, to call us to meals, and to summon servants. Instruments of various bell-types are also important members of the modern orchestra (see Musical Instruments).

The Giants among Bells

The largest bell ever cast is the "Czar Kolokol" at Moscow, which weighed about 200 tons when it was cast in 1733. It has never been rung, however, as it was cracked during the fire of 1737. The great bell is over 21 feet in diameter and stands 19 feet 3 inches high; it now rests on a raised platform, inside the Kremlin walls. Another Moscow bell, the largest in actual use, weighs 110 tons. There is a great bell of about 87 tons in a pagoda in Upper Burma, and one of 53 tons at Peking. Beside these monarchs the other famous bells of the world are dwarfs. "Great Paul" in Saint Paul's Cathedral, London, weighs 17 tons; "Big Ben" in the Westminster clock



The Czar bell in Moscow is the largest bell in the world. It is 19 feet high, 60 feet in circumference, and weighs 200 tons. The outside is adorned with inscriptions and reliefs. The bell was cast in 1733, but before it left the foundry a fire broke out, and cracked it as you see here, so that its giant voice was never heard.

tower of the Houses of Parliament, London, 13½ tons; "Great Tom" at Oxford, 7½ tons. The largest bell in America, in Riverside Church, New York City, weighs 25 tons, "swinging weight." The most famous bell of the United States is the Liberty Bell, which rang out the news of the Declaration of Independence in 1776.

BELL, ALEXANDER GRAHAM (1847-1922). Other men before Bell had worked at the problem of transmitting to a distance the sound of the human voice, and many other men since have helped to improve and perfect Bell's invention. But Alexander Graham Bell will always be remembered as the real father of the first

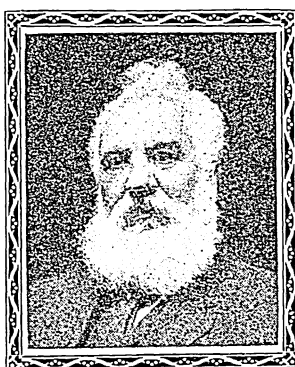
practicable electric telephone.

He was born in Edinburgh, Scotland, and was educated in the Universities of Edinburgh and London. In 1870 he removed to Canada with his father and the rest of the family. His father and his grandfather before him had devoted their lives to the study of human speech and to teaching the deaf and dumb to speak, and this became the profession also of Alexander Graham Bell.

During 1874-75 he worked at the problem of the telephone. It was on March 10, 1876, that the first spoken message successfully transmitted by wire was sent by him to his assistant in a Boston hotel. He filed his application for a patent for his invention February 14 of that year, just two hours before Elisha Gray filed a notice

in the Patent Office covering some of the same principles. At the Centennial Exposition of 1876, in Philadelphia, the demonstrations of Bell's telephone

ALEXANDER GRAHAM BELL



Inventor of the Telephone

HERE SLEEP THE BRAVE NEAR BELLEAU WOOD



This spot in the Marne Valley in France is sacred to the memory of American soldiers. The rows of tombstones mark the graves of the heroes of the Marine Corps who died at Belleau Wood. This photograph was taken not long after that fierce encounter, in which the Marines drove through the German lines under a hail of shot and shell. The torn trees show the effects of the withering shell fire. The Americans had taken all the Belleau Wood by June 21, but the battle continued until July 7, 1918.

made a great sensation. That same year the first long distance telephone conversation took place between Boston and Cambridge.

Although Bell's fame rests chiefly on the invention of the telephone, his main interest throughout life was helping the deaf. In 1871, in Boston, he started teaching the deaf, and the following year he opened a private school to train teachers of the deaf in the methods of "visible speech," which had been devised by his father, Alexander Melville Bell (1819-1905). In 1873 he began teaching at Boston University. When he went to England in 1877 to promote his telephone, he displayed active interest in the education of the deaf there. In 1880 he received the Volta prize of 50,000 francs from the French government for his invention of the telephone and used the money to found the Volta Laboratory in Washington, D.C. In 1887 this laboratory became the Volta Bureau for the Increase and Diffusion of Knowledge Relating to the Deaf.

Bell became a citizen of the United States in 1882 and served as president of the National Geographic Society and as a regent of the Smithsonian Institution. Among his various inventions was an audiometer, for measuring the intensity of sound. He also experimented in aviation. Many universities and learned societies honored him with degrees and medals.

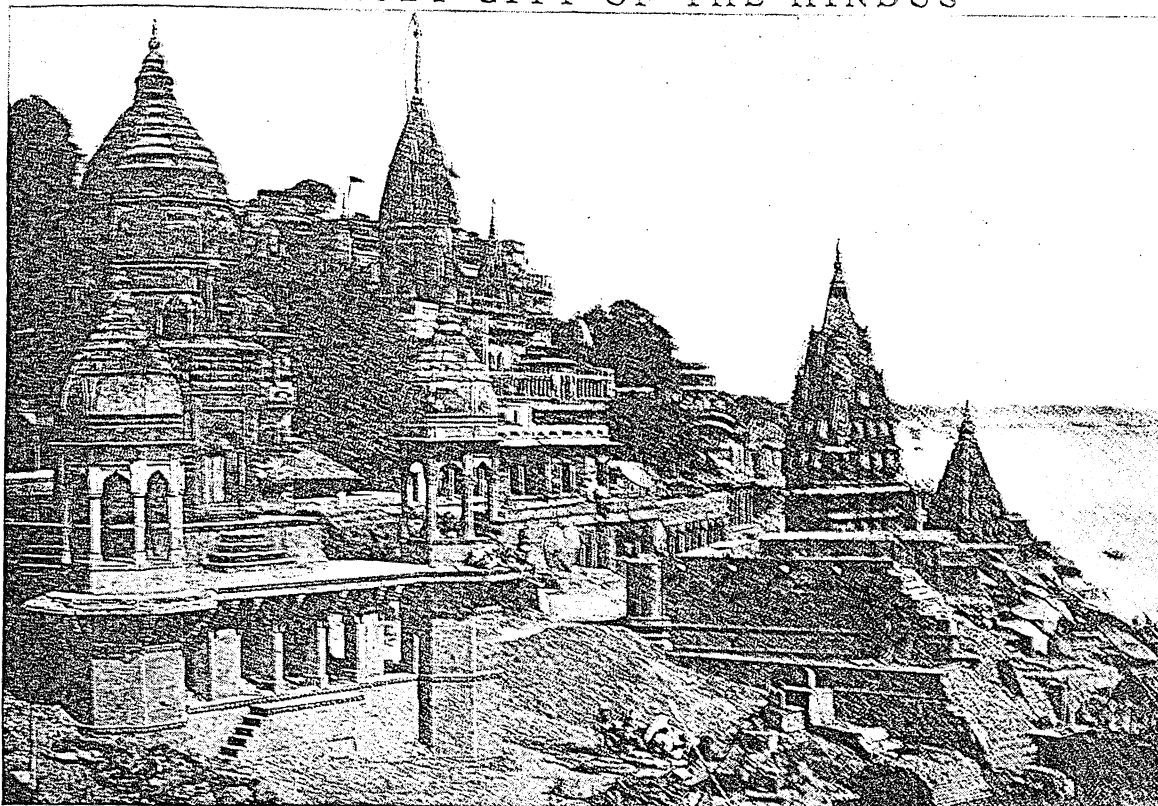
BELLEAU (bê-lô') WOOD, FRANCE. Five and a half miles northwest of Château-Thierry stands Belleau

Wood—the scene of one of the first and most glorious exploits of the American troops in the World War of 1914-18. There, early in June 1918, the Marines of the 2d Division, assisted by the regulars of the 3d Division, advanced into a rocky jungle of machine-gun nests, and alternately held fast or charged with their battle cry of "E-e-e-e-y-a-a-h-h-yip!" until they had driven out the Germans and captured the village of Bouresches, two miles to the south. Of this gallant exploit the report of the Secretary of the Navy said:

"In all the history of the Marine Corps there is no such battle as that one in Belleau Wood. Fighting day and night without relief, without sleep, often without water, and for days without hot rations, the Marines met and defeated the best divisions that Germany could throw into the line. The heroism and doggedness of that battle are unparalleled. Time after time officers seeing their lines cut to pieces, seeing their men so dog-tired that they even fell asleep under shell fire, hearing their wounded calling for the water that they were unable to supply, seeing men fight on after they had been wounded and until they dropped unconscious; time after time officers seeing these things, believing that the very limit of human endurance had been reached, would send back messages to their post command that their men were exhausted. But in answer to this would come the word that the lines must hold, and if possible those lines must attack. And the lines obeyed. Without water, without food, without rest they went forward—and forward every time to victory. Companies had been so torn and lacerated by losses that they were hardly platoons; but they held their lines and advanced them. In more than one case companies lost every officer, leaving a sergeant and sometimes a corporal to command, and the advance continued."

BENARÉS, INDIA. With its 1,500 temples and more idols than inhabitants, the ancient city of Benares is the Mecca of all Hindus. Its very air is holy; its

THE HOLY CITY OF THE HINDUS



At Benares the sacred Ganges, whose waters you see on the right, makes a magnificent sweep some four miles in length. On the outside of this curve and on a rising bank stands this group of great temples. During certain seasons of the year the river here is filled with pilgrims from all parts of India, purifying themselves in the holy waters. In the foreground of this picture are the "burning ghats" where you see a little group of people about a pyre ready for the cremation of a body.

soil so sanctified that to carry away its dust on your feet is a sin. Pilgrims in countless numbers visit it to wash their sins away in the sacred Ganges, and many of the wealthy spend their declining days here, for he who dies at Benares is sure of immediate admission into heaven.

From the river you see Benares as a richly colored jumble of temples, mosques, palaces, domes, and minarets flung haphazard along the steep bank. At the water's edge run the famous *ghats* (steps), a four-mile curving row of stone terraces.

You cannot see the city from a *gharri* (carriage); its canyon-like streets, rising in narrowing flights of steps, are barely wide enough for a single horseman. You must go on foot through the cold slippery passageways, threading your course amid bewildered pilgrims making the rounds of the sacred road (called *Panch-kos*) and thus being cleansed from all sin. Now and then you will have to give way to a sacred bull which wanders unrebuked from one grain-seller's stall to another, nibbling where he will. You pass the Golden Temple, holiest of all, its floor paved with silver rupees, and go into a crowded sanctuary, where burning camphor-laden leaves are dropped by worshipers, crowding round the mouth of a pit, to illumine far below a flower-enshrined image of the god Siva.

Often you stop to watch a weary sinner, who has stepped aside a moment from the surging throng to make *pūja* (worship) before a shrine, at which he leaves two *pice* (copper coins) and a load of sins. Beggars swarm everywhere.

Go down to the ghats—what a sight greets the sun each morning as it rises out of the richest plain in all India! Gray granite and red temple walls, the golden shafts of slender spires, the stately minarets of a hidden mosque, a *mullah* (Mohammedan priest) counting his beads while he drones a passage from the Koran, monkeys gamboling over temple walls, lazy *fakirs* (holy men) clothed in nakedness and ashes, fat Brahman priests thumbing sacred texts beneath flame-colored umbrellas. The sweeper's wife, knee-deep in "Mother Gunga," as the Ganges is piously called, dabbles at a red *sari* or copper pot, her prayers finished; three feet away a high-caste banker, filling his cupped hands with Ganges water, sends his praises to the sun, "who illumines the whole world, the lord of all creatures—may he enlighten my soul!"

Naked children dart in and out of the water near a great pyre or funeral fire, where circling wreaths of smoke rise around a smoldering corpse, while the soul, freed by the cleansing flames, slips out into the next stage of endless reincarnation. Troops of women,

their ablutions over, patter off up the steps, straight of limb, aristocratic in every line, like slim goddesses. The tinkle of their silver anklets mingles with the ceaseless chatter of monkeys, the rattle of metal and resounding clang in the brassware bazaars, sharp piercing conch blasts, the muffled murmur of swarming worshipers, the deep booming of the temple drums.

Benares was a center of importance when Buddha came there, six centuries before Christ, but its buildings are all comparatively modern. The houses are generally shops on the ground floor; their upper stories, often as many as five or six, are made more livable by projecting balconies and verandas and their walls are garish with bright colors. Population, about 200,000.

BENEDICT XV, POPE (1854-1922). Giacomo della Chiesa, Pope from 1914 to 1922, came of an old and noble family of Genoa, which counts in its history two saints, a cardinal, and several bishops. Perhaps it was this tradition that early turned inclinations of the young Giacomo to the church. In obedience to his father's wishes he completed a course in law at the University of Genoa, winning a high place in his class. But the day that he took his degree, he said:

"Father, I have obeyed you about my studies and now wish my reward. I must enter the church."

He was ordained to the priesthood at 24, and became secretary to Cardinal Rampolla, papal nuncio at Madrid and later the papal secretary of state at Rome. In this capacity he gained an acquaintance with international politics and diplomatic procedure which proved invaluable when he himself was elevated to the highest office in the church.

In 1907 the future Pope was created archbishop of Bologna. In May 1914, he was made a cardinal; and in September of the same year, following the death of Pope Pius X, he was elected Pope in a conclave which lasted only four days—the shortest in the history of the papacy up to that time.

The new Pope found himself facing such problems as had confronted none of his predecessors. Half the world was in arms, waging the fiercest struggle of all time; and adherents of the Catholic faith were found on both sides. The policy he set for himself was the observance of strictest neutrality, accompanied by unrelenting endeavor to effect peace at the earliest possible moment.

The Pope outspokenly condemned Germany's violations of the laws of war, such as the destruction of the cathedral of Reims, and obtained some improvement in the treatment of prisoners of war by the Central Powers. In August 1917 he invited the belligerents to make peace upon a basis of the restitution of all occupied territory, renunciation of indemnities, decrease in armaments, freedom of the seas, and international arbitration. The Central Powers returned an evasive reply. President Wilson, as spokesman for the Allied Powers, answered by pointing out in substance that such a program would be fruitless so long as the people of Germany were dominated by an irresponsible and militaristic government, whose word could not be trusted.

Pope Benedict was an accomplished and ardent scholar, remaining true amid the distractions of his busy career to the ideal of his youth. So intense was his devotion to his studies as a lad that his mother, to induce him to take needed exercise, gave him a spade and bade him spend a few minutes every day digging in the garden. A palm planted by the future Pope is now one of the most prized possessions of his boyhood home. As Pope, he clung to the studious and simple habits of his youth, being always found at his altar by half past five or six, and at his desk ready for work by eight o'clock. He died Jan. 21, 1922.

Of the earlier popes who have borne the name Benedict, the first, 575-579, died of grief during the Lombard devastation of Italy. Benedict V, 964, was carried to Germany by the Emperor Otto I and died a prisoner there. The name Benedict XIII was taken by the Spaniard Peter de Luna, one of the anti-popes, 1394-1424, at Avignon during the Great Schism; it was also borne by the canonical pope at Rome, 1724-30. Benedict XIV, 1740-58, was renowned for his great learning and piety, and for his measures to promote the well-being of the city of Rome.

BENEDICTINES. An order of monks established by St. Benedict in Italy about A. D. 530. Because of the color of their robes they are sometimes called "Black Monks." There is also an order of nuns of the same name. (See Monks and Monasticism.)

BENGAL. This province in the northeastern part of British India is about the size of Kansas, but it has almost thirty times as many people. In its 83,000 square miles are concentrated 51 million inhabitants, more than 600 to each square mile. Crops to feed these multitudes of Bengal are grown on its fertile lands in the deltas of the Ganges and Brahmaputra rivers. Rice is the staple crop. Dates, sugar, wild silk, jute, tea, and opium are other important products. Bengal grows the best cotton of India, and it is a chief center for the manufacture of cotton goods. It is also an important producer of coal and iron. Calcutta is the capital and largest city.

Bengal was the first district in India in which the British passed from mere trading rights to the exercise of the right of government. Here was fought (in 1757) the battle of Plassey which established British in place of French supremacy. The people are predominantly Hindus, intelligent, politically active, but non-warlike. (See Calcutta; India.)

BENTON, THOMAS HART (1782-1858). The first and one of the greatest of statesmen to arise in the vast region west of the Mississippi River was Thomas Hart Benton, for 30 years United States senator from Missouri. Although Benton typified the West and identified himself largely with its interests, he is forgotten by many today, while his great contemporaries, Clay, Webster, and Calhoun, the champions of North and South, are remembered by all.

Born in the interior of North Carolina, Benton followed the frontier to Tennessee, where he was admitted to the bar and began his political career as a member of the state senate. Although he was a member of Gen. Andrew Jackson's staff during a part of the War of 1812, the two became involved in a duel,

and Jackson was wounded. This broke the friendship between them, and it was not renewed until after Benton entered the United States Senate in 1821. Then he agreed with Jackson's political views, and as long as "Old Hickory" was president (1829-37), Benton supported his policies (see Jackson, Andrew).

Benton was always a champion of the West. He urged a liberal land policy and construction of trans-continental railroads, saying: "There is the East; there is the road to India." But eventually he sacrificed his political career rather than yield to the sentiment in favor of slavery in Missouri. In 1850, after 30 years in the Senate, he was defeated for re-election because he opposed the Compromise of that year. Thereafter he was elected for one term to the national House of Representatives (1853-55). He spent the rest of his life writing his 'Thirty Years of Congress', and arranging for publication congressional debates down to 1850.

Although Benton died before the Civil War began, his influence helped hold Missouri in the Union. His words to Calhoun were frequently recalled: "I shall be found in the right place—on the side of my country and the Union!"

BENZENE. One of chemistry's most useful substances is the colorless, oily liquid called benzene. It dissolves gums, resins, fats, and oils. Chemists can convert it into a host of drugs and dyes.

Benzene owes its usefulness to its chemical structure. It contains six atoms of carbon, linked in a ring, and each carbon atom has one atom of hydrogen attached to it (see Chemistry). Various compounds can be attached in place of hydrogen atoms, and two or more of the carbon rings can be linked together, to furnish the various substances desired. These substances are called *aromatic hydrocarbons*, because many of them have a pleasing odor.

Benzene is obtained by distilling coal tar at about 212° F. (see Coal-Tar Products). This yields an impure product called *benzol*. Pure benzene is obtained by washing benzol with sulphuric acid, then with caustic soda solution, and redistilling at the boiling point of benzene, 177° F. or 80.4° C. Much of the benzol produced is used, however, not for benzene, but in motor fuel. It gives good power and it has high antiknock properties.

Both liquid benzene and its vapor are highly inflammable and poisonous. No flame should be permitted near benzene. First aid after benzene poisoning consists of removing the patient immediately into the fresh air. A doctor should be summoned for further treatment.

Benzene was discovered by Michael Faraday in 1825, in illuminating gas made from oils and fats. In 1845 A. W. von Hofmann obtained it from coal tar, and in 1865 F. A. Kekulé worked out the chemical formula C_6H_6 and the "benzene ring" structure. These latter discoveries led to the many modern uses of benzene.

A substance often confused with benzene is *benzine*, a heavy naphtha obtained from petroleum (see Petroleum). It is used in dry cleaning to dissolve fats and oils, and to dissolve paints and rubber. It is highly inflammable, and should be used outdoors.

BEOWULF (*bā'ō-wulf*). The ancestors of the English, like all primitive people, delighted in listening to their minstrels or poets, who sang of war and deeds of valor, of great heroes and chieftains. When these people left their homes on the continent and came to the British Isles, they brought with them songs relating to the deeds of their hero Beowulf. Later these songs were woven together into the great Anglo-Saxon epic or heroic poem which bears his name.

The poem tells how the "battle-brave" Beowulf came over the sea from Geatland (possibly the Sweden of today) to the land of the Danes and freed that country from the terrible ogre Grendel; how he was forced to battle with Grendel's mother, who came to avenge her son's death; and how, long afterward, when Beowulf had been king of the Geatas for half a century, he came to his death in killing a fire-breathing dragon which had ravaged the land. Amid the mourning of his subjects the good king was buried under a great barrow, or mound, while the warriors rode around it singing that he was—

... of kings, of men,
The mildest and the kindest, and to all
His people gentlest, yearning for their praise.

'Beowulf' is the earliest English epic poem. Since the time when it was written the language has undergone such changes that only those who have studied the old Anglo-Saxon language can read the story in the original. It has been translated into modern English, however, and in this form may be read by any boy or girl who likes a story of heroism and adventure.

Scholars do not agree as to how old the epic is or when it was first put into writing, but the oldest manuscript we have was written in the 10th century. This is now in the British Museum, London.

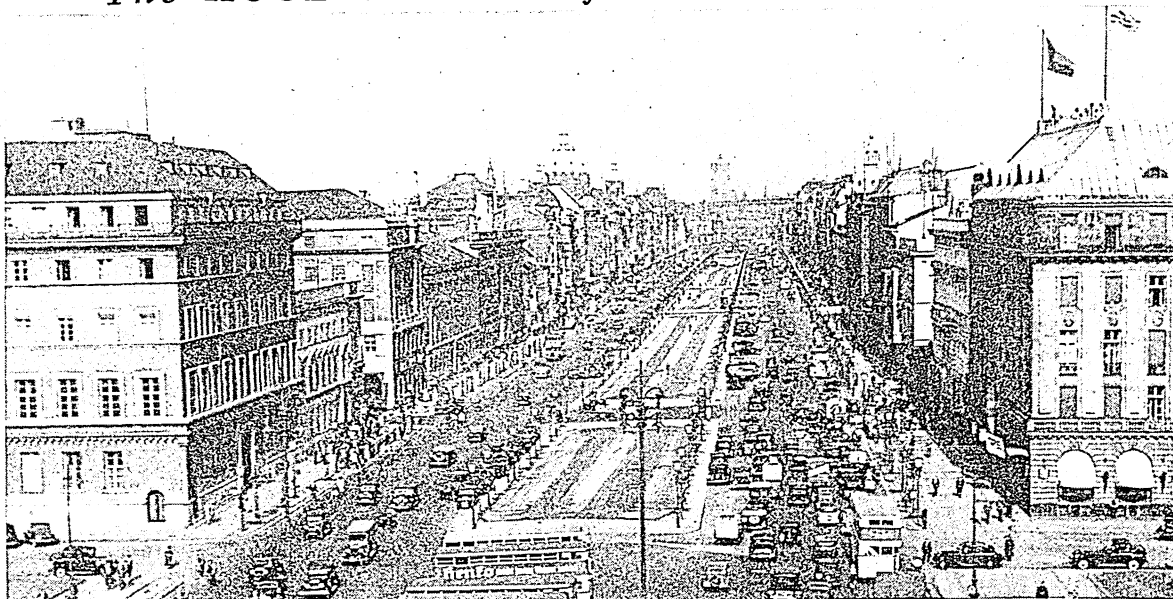
BERING SEA. Both the sea and the strait called Bering were named in honor of Vitus Bering (or Behring), a Danish navigator in Russia's employ, who made the first systematic explorations in 1728 and 1741. They had been discovered, however, by a Russian, Simon Deshnef, in 1648.

The sea, an arm of the Pacific Ocean, extends north about a thousand miles from 52° north latitude to the Arctic Circle, where Bering Strait connects it with the Arctic Ocean. Its east-west extent is 1,700 miles, from 160° east to 160° west longitude, and its area, 878,000 square miles. Alaska lies to the east, Siberia to the west, and the Aleutian Islands and the Alaska Peninsula to the south.

In its narrowest part, the strait is between 40 and 60 miles wide and between 120 and 180 feet deep. Most of Bering Sea is equally shallow, though in places it reaches depths of 12,000 feet. Three great rivers, the Kuskokwim and the Yukon in Alaska and the Anadir in Siberia, discharge into it. Fogs, storms, and ice make navigation dangerous throughout most of the year.

In 1881 the United States sought to declare Bering Sea a *mare clausum* or "closed sea," open to navigation and sealing only under conditions imposed by the United States; but an international court of arbitration, in 1893, refused to recognize this claim.

The HUGE CAPITAL of the GERMAN REICH



This is a full-length view of "Unter den Linden" (Under the Lindens), Berlin's most famous street. The view was made from the top of the Brandenburger Gate, looking eastward to the old imperial palace. Behind the palace looms the tower of the City Hall. When a subway was dug beneath that central parkway, the old linden trees perished, but they have been replaced by young silver limes which are harder members of the linden family.

BERLIN, GERMANY. No city shows better than Berlin how energy and ambition can overcome natural handicaps. Located in a region where soil is poor and mineral resources few, it has become Germany's chief commercial center. From a swamp village, it has grown through seven centuries into a great political center—first as the capital of Brandenburg, then of Prussia, and finally of all Germany. Step by step Berlin has kept pace with the rise of Prussia under the rule of ambitious Hohenzollern electors and kings. (See Germany; Prussia.) Today Berlin is a city of more than 4 million people—the largest in continental Europe.

How Climate and River Helped Build the City

The situation of Berlin tells us, in part, why it thrives despite a lack of natural resources. It lies so far north that its longest days in summer have 18 hours of sunlight. The climate is invigorating, with average temperatures of 31° in January and 65° in July. Hence the people have energy to make the most of their opportunities. The city lies almost midway between two mighty rivers—the Elbe, to the west, and the Oder, to the east. Lakes, marshes, streams, and pine forests abound in this region. The Spree River flows through the city and joins the Havel near its western limits, connecting with a vast system of rivers and canals.

Berlin makes such wide use of these rivers and canals that it ranks, after Duisberg-Ruhrort, as Germany's principal inland port. It has water connections with Hamburg, on the North Sea; with Stettin, on the Baltic; and with inland cities, including Magdeburg and Breslau. From these and other cities

come thousands of boats bringing cargoes that total millions of tons each year. Berlin is principally a consuming and distributing city, and its imports by water far exceed exports. Foodstuffs, fodder, building materials, coal, and oil are a few of the products unloaded by gigantic cranes along miles of docks. Hides, paper, steel, and other bulky imports from abroad commonly reach Berlin after reshipment on canal boats from German seaports.

Transportation by Land and Air

The nation's railways, highways, and air lines center in Berlin. Railways radiate to all parts of Germany and to other countries of Europe. A circular or belt railroad (*Ringbahn*) connects the stations of the main lines entering the city and makes it possible to switch freight from one line to another. A through line (*Stadtbahn*) cuts across Berlin to give direct connections east and west. A vast system of subways, streetcars, busses, and suburban railroads makes it easy to reach any part of the city and its suburbs. The *Autobahn*, a great motor highway, encircles the metropolis to speed the flow of cross-country traffic by directing it around instead of through the city. Within the city are more than 2,700 miles of paved streets. The Tempelhof airport, one of the largest and best-equipped airports in the world, swarms with planes arriving from or departing for every major European capital and commercial city. There are also regular connections with the Orient, Africa, and South America.

Manufactures and Trade

Factories cover large areas on the north, east, and south sides of the city, and recently have spread to

the west. Most of the products in which Berlin specializes require technical skill in their manufacture. Electrical appliances, industrial machinery, fine textiles and clothing, chemicals, furniture, sewing machines, scientific instruments, office machines and supplies, locomotives and other railroad equipment, china, and books are some of the more important products that go from Berlin's factories to many parts of the world. So vast have some of the factories grown, that the settlements of employees around them resemble cities. The larger concerns provide apartments for workers and their families. One concern even provides churches, schools, playgrounds, and hospitals for its employees' settlement, which is a good-sized city in itself.

A greater volume of buying and selling is carried on in Berlin than in any other German city. There is a large commerce in cattle, wool, lumber, iron, coal, and grain. As a grain exchange, Berlin is the German Chicago. As the leading banking and securities trading center of the country, it resembles London, New York City, and Paris. Food-packing establishments, notably slaughterhouses, do a huge business supplying local markets.

Few Reminders of the Past

Unlike Paris and Vienna, Berlin has little to remind the visitor of its medieval origin. Few buildings are more than 100 years old. Many apartments, hotels, office buildings, and department stores are ultra-modern in design; some suggest the skyscrapers of New York City and Chicago. Residential districts are severely trim and neat; even the humblest cannot be classed as slums. Tall monuments, with statues of kings, military heroes, and scholars, stand in public squares as reminders of the stirring past.

Only from 115 to 165 feet above sea level, the city lacks the grandeur of mountains and hills, but it has a wealth of trees, lakes, and wooded parks, such as the 550-acre Tiergarten, the Zoölogical Garden, and the Grünewald. A delight to the romantic are the canals and rivers, spanned by a greater number of arched bridges than even Venice can boast. There are hundreds of sport fields, chief of which is the Reich Sport Field. This field was the scene of the 1936 Olympic Games. Its stadium seats more than 100,000 persons.

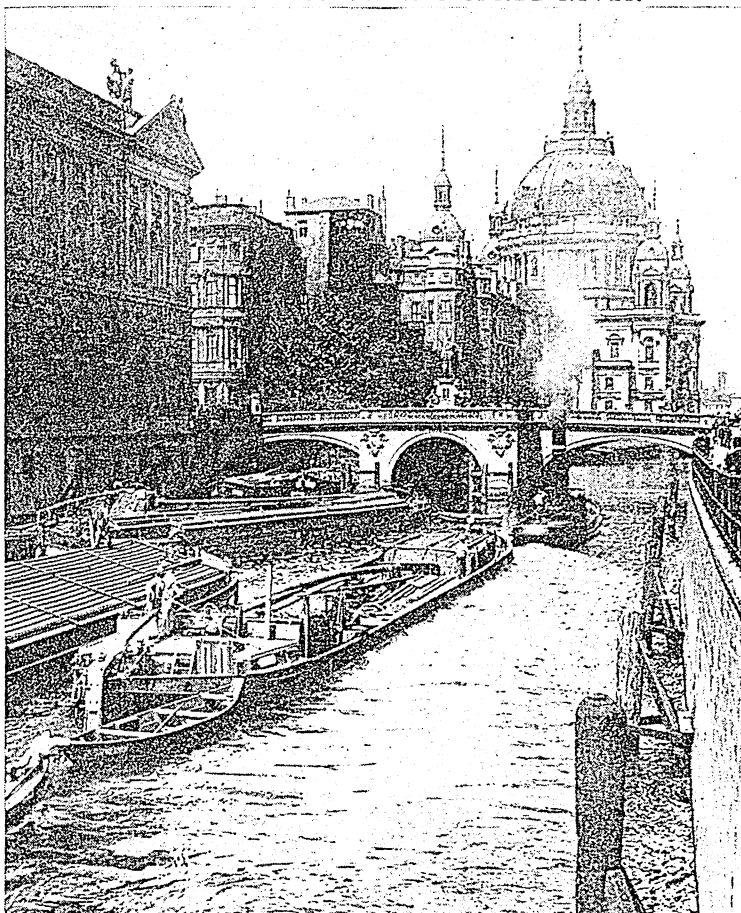
Where Visitors Linger

Between two arms of the Spree River on the east side of the city is Spree Island, known as Alt-Kölln (old

Kölln), where one of the first settlements stood. Here are many picturesque buildings, representing various styles of architecture, from medieval to classic. Especially admired are the 600-room imperial palace, several museums full of art treasures, and the Lutheran Cathedral, or *Dom*, built early in the 20th century. Bridges lead east across the Spree River to the old town. Here stand the Town Hall and St. Nicholas Church. The latter dates from the early 13th century and is believed to be the city's oldest church.

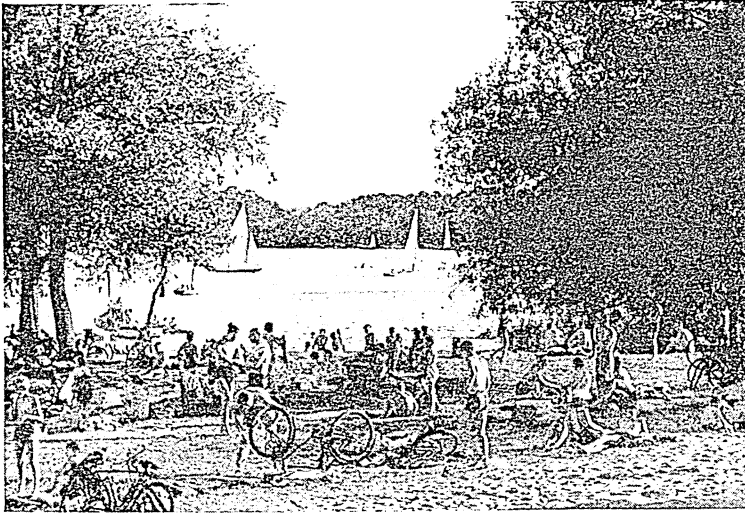
Extending west from Spree Island is Berlin's most famous street—Unter den Linden—so named because of the trees that used to line its central parkway. The lindens have now been replaced by silver limes. This thoroughfare, 197 feet wide and nearly a mile long, ends at the Brandenburger Tor, a majestic gate with five passageways leading into the Tiergarten and the Zoölogical Garden. This gate is the only one remaining of the 16 that formerly led into the old walled city. Along Unter den Linden rise impressive buildings, including the state opera house, embassy buildings, state library, and fine hotels. Here too

BARGE TRAFFIC ON THE SPREE RIVER



An almost constant stream of shipping is carried through the heart of Berlin by the Spree River. Here the river flows under the Elector's Bridge toward the Lutheran Cathedral in the background and past the old imperial palace at the left. The barges are towed by sturdy tugboats like the one near the bridge.

ONE OF BERLIN'S POPULAR PLAYGROUNDS



The tree-lined banks of the Havel River east of the city attract picnickers, bathers, and boating enthusiasts during the summer months—a typical Sunday scene.

is the University of Berlin, now considered Germany's chief center of learning, though it was not founded until 1810. In this quarter of the city, but on other streets, are the Reichstag Building, the Royal Theater, the Lutheran Cathedral, and the Prussian Parliament Building. Friedrichstrasse (Frederick Street), which crosses Unter den Linden at right angles, is one of the principal business arteries.

Beginning and Early Growth

Berlin, with its twin town Köln, was founded in medieval times at the place where the main trade route from Leipzig to Stettin crossed the Spree. Some historians believe the settlement was founded in 1237; others set the date even earlier. Berlin-Köln became a center for boat-building and trade in grain, herring, and wood. Though the two towns became important enough to join the Hanseatic League, they did not become rivals of the older and richer cities of Germany for several centuries.

Toward the end of the 15th century, Berlin-Köln became the capital of Brandenburg. It grew in prestige as the princes of Brandenburg extended their power, until they became rulers of all Prussia. Frederick William, the Great Elector, who ruled from 1640 to 1688, enlarged it, had architects plan public squares and buildings, and built a strong, high-towered wall. He completed the first canal connecting the Spree with the Oder, thus giving Berlin a water outlet to Stettin, and he laid out the now world-famous thoroughfare, Unter den Linden. His successor, who became king of Prussia in 1701, under the title of Frederick I, united Berlin with Köln and with the suburbs that had grown up. Thenceforth the whole municipality had the name "Berlin."

When Frederick the Great came to the throne in 1740, Berlin had 72,000 people. He anticipated standards of modern city planning by insisting that all buildings be well made and of harmonious design, and gave lots to citizens who agreed to build homes and shops with attractive fronts. He built a fine opera house, set aside the Tiergarten as a city park, and established a huge and ornate palace—Sans Souci—in the then new and fashionable suburb of Potsdam.

Succeeding kings added streets, buildings, and monuments to Berlin. Despite temporary setbacks, such as the occupation of the city by Napoleon in 1806, the city continued to grow. By 1815 it had world importance, though its population of 198,000 was still less than half that of Paris and hardly one-fourth that of

London. Berlin's population was 330,000 by 1840; more than 500,000 by 1860; and more than 800,000 at the time of the Franco-Prussian War in 1870.

Capital of All Germany

Berlin became the capital of all Germany in 1871, when the Prussian chancellor, Otto von Bismarck, created the German Empire by consolidating all the

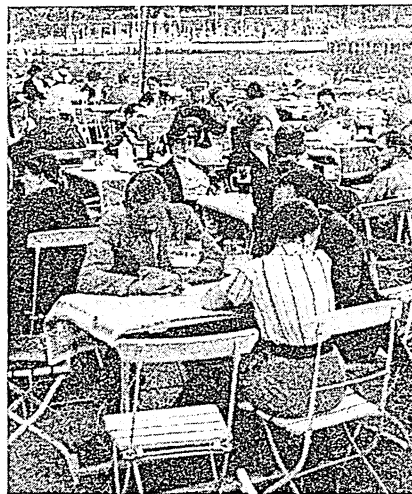
German states. The city immediately set about to modernize itself. Housing conditions were improved, open sewers were replaced by a drainage system leading to sewage disposal farms in the country, a modern water-supply system was laid out, and hundreds of miles of cobbled streets were surfaced with asphalt. By 1900 Berlin was clean and healthful, and had, including suburbs, over 2½ million people—more than thrice its population of 1870.

In 1911 Berlin and its suburbs formed a

loose federation for certain common needs, such as street lighting, transportation, education, and police regulation. The first World War forced a closer union and in 1920 all were united into a single municipality (now 341 square miles) under one administration.

But the war and its aftermath had brought depression, food shortage, and consequent high prices. Serious riots rocked the city while the imperial government

AFTERNOON IN A BEER GARDEN



Somewhere in the background a band is playing, while men and women, young and old, sip their beer, coffee, or *Berliner Weisse*, a favorite summer brew served in large round goblets.

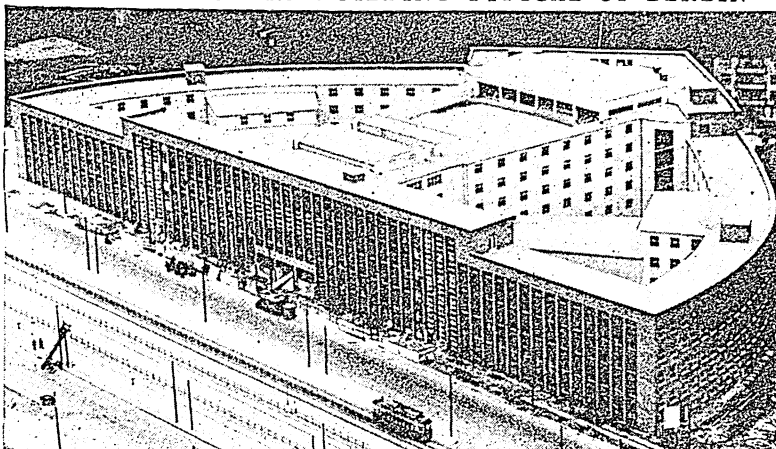
was being overthrown and a republic set up. With Hitler's rise to dictatorship in 1933, order was firmly re-established, and a program launched to make Berlin even mightier and more brilliant than in the days of the Hohenzollern rulers.

Plans for a Greater Berlin

In 1937 Hitler announced plans to remodel the transportation system of Berlin by 1950. Work on this vast project is already under way. The city will have two main traffic arteries—one, 24 miles long, running from north to south; the other, 33 miles long, from east to west. Their maximum width will be about 100 yards. These arteries will intersect at the Tiergarten, where an underpass will prevent traffic clashes. The east-west artery, which includes Unter den Linden, already extends as far east as the Spree. The north-south artery has yet to be built, and will be the more imposing of the two, because of the new government buildings which are to be erected near its crossing at the Tiergarten. Four rings of boulevards are to circle the city, at distances of 2, 4, 6, and 8 miles from the Tiergarten intersection. Two railway terminals, one at the north and the other at the south, will replace the several terminals now scattered through the city. Subways are to be enlarged and extended.

Considerable progress has been made in this vast program, but work has been curtailed since 1939. For at the outbreak of the second World War, Berlin laid

AN ULTRAMODERN BUILDING TYPICAL OF BERLIN



Berlin is trying many experiments in architecture. This building, the city's chief broadcasting station, has the outlines of a pointed arch with internal ribs. Note how the ribs are provided with windows to give the inside offices a maximum of light and air.

aside many of its ambitious plans. And as the conflict wore on, Berliners saw Unter den Linden, the state opera house, and other notable spots damaged by incendiary and explosive bombs dropped by the British air force. Population of Berlin, about 4,335,000.

BERMUDAS. One of the most isolated places in the world, and yet one of the most popular as a tourist resort, is the group of British islands called the Bermudas. They are hardly larger than specks in the Atlantic Ocean, and the nearest land is Cape Hatteras, in North Carolina, 580 nautical miles west. They can be reached, however, by steamship from New York City in less than two days, or by airplane in five hours. Their delightful climate, unique beauty, and freedom from noise, haste, and dirt attract thousands of visitors each year. One of their special charms is the absence of motor traffic, for private automobiles are banned and everyone travels by bicycle, carriage, or the motor-powered railroad.

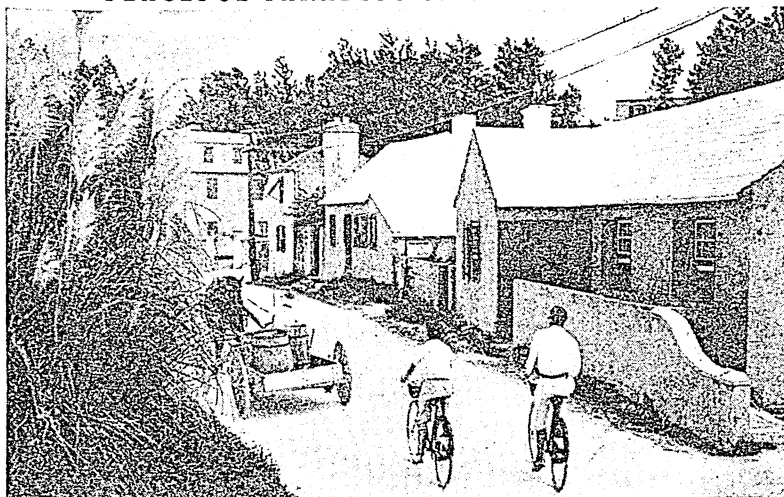
On a map, the Bermudas look somewhat like a fish hook, with the curve at the southwest and the shaft extending northeast. They are nearly surrounded by reefs, on which countless vessels have been wrecked. There are more than 100 islands, but their total area is only about 19 square miles. The island called Bermuda is larger than all the rest combined. Only a few of the islands are inhabited, and their total resident population hardly exceeds 30,000. About 40 per cent of the people are whites; the rest are Negroes, descendants of the slaves freed in 1834. The capital and chief port is Hamilton (population, about 3,000), on the island of Bermuda. Darrell Island near by is the terminus for seaplanes. On St. George's Island, at the east end of the group, drowns the picturesque old port

THE BRANDENBURGER GATE, SYMBOL OF VICTORY



This gate is a monument to the old principality of Brandenburg, out of which grew the mighty Kingdom of Prussia (see Prussia). The figure above the gate drives a four-horse chariot and carries a standard bearing the Iron Cross and the Eagle of Prussia. During the second World War, the gate was hit by bombs.

PEACEFUL PARADISE OF THE ATLANTIC



Typical of the Bermudas is this scene on tiny Paget Island at the northern end of the chain. Visitors are charmed by the quiet clean streets lined with white stone houses.

of St. George. Because of its strategic situation the group is an important outpost of American defense. It is a British naval station, and the United States has an air and naval base on land leased to it in 1940.

The average temperature is about 70° F. In winter it is seldom cooler than 55°; in summer, rarely hotter than 87°. The heavy rainfall (nearly 60 inches a year) and brilliant sunshine encourage vegetation. Forests of Bermuda cedar (a species of juniper) cover the low hills. Palms of many kinds, fiddlewood, allspice, and swamp mangrove are other common trees. Hibiscus, oleander, croton, poinsettia, frangipani, and many other flowering plants and trees bloom lavishly. Acres of Easter lilies are cultivated for export and for making perfumery. Farms yield large vegetable crops the year round. About 200 species of birds have been noted, but most of these are migratory birds blown off their regular routes. Bluebirds, cardinals, ground doves, white-eyed vireos, catbirds, and English sparrows are year-round residents. The waters teem with fish, many of them remarkable for their striking colors and markings—sea horses, amber fish, groupers, angel-fish, and many others. Tuna, bonito, and barracuda are the chief game fish.

The Bermudas are believed to be the peaks of a volcanic mountain rising steeply from the bottom of the ocean to about 200 feet below the surface. Above this level the islands consist mainly of limestone formed by sea shells and corals. In many places, this stone crops out above the thin soil covering. Along the shore rise huge rocks, sculptured by wind and water into fantastic pinnacles, pillars, and grottoes. The reefs surrounding the islands mark the northernmost habitat for coral insects, and are still being incrustated with their secretions.

This stone gives the Bermudas excellent roads and building material. White and smooth, the roads are simply the stone laid bare by stripping away surface

soil or small hills. The stone is so soft that it is cut with handsaws, but it hardens with exposure to air. Not only the walls but also the roofs of the houses are built of stone, for the roofs are used to catch the rainwater, which is the chief water supply.

Tourists Support Colony

In some years, more than 75,000 tourists, most of them from the United States and Canada, visit the islands. The money they spend makes up about 80 per cent of the total income of the colony. Much of the money is spent in the fine hotels, or in the stores, or for recreations, such as yachting, golf, tennis, fishing, swimming, and bicycling. Another source of income is the export of Easter lilies—bulbs

and flowers—to the United States, England, and South America. Potatoes, tomatoes, carrots, celery, and other vegetables are exported for winter sale to Canada and the United States. Meat, flour, and most other foods are imported from the same countries.

The Bermudas get their name from the Spaniard Juan de Bermudez, who is credited with discovering the islands before 1515. They are also called the Somers Islands, after Sir George Somers, who first settled them early in the 17th century. Since 1684, the Bermudas have been a crown colony of the British Empire. The legislature consists of a governor, a legislative council, and a house of assembly. The governor is appointed by the crown, as are the nine members of the legislative council. The 36 members of the house of assembly are elected, four from each of the nine parishes. Only property owners may vote.

BERN, SWITZERLAND. As the capital of the Swiss Confederation and the headquarters of several international associations, Bern is a city of world importance despite its relatively small population. The beauty of its situation and its many fine old buildings make it one of the most attractive and impressive cities of Europe.

It stands near the center of the Swiss plateau between the Alps and the Jura Mountains. The older part of the city occupies a high peninsula formed by a loop of the river Aar. Several bridges connect the old town with the newer residential quarters. The public walks, which have taken the place of the old fortifications, command glorious views of the Alps. Arcades (covered walks) line the streets of the old town, sheltering pedestrians from the weather.

The deep tones of bells, centuries old, draw visitors to Bern's great cathedral, begun in 1421. Almost as impressive is the old Council hall (*Rathaus*), also dating from the Middle Ages. Not far away, a curious old clock tower heralds the striking of the hour with the crowing of a cock and a procession of toy bears. It is from the German word *Bären*, meaning "bears," that the city is said to take its name, and so several fat bears are kept in a pit on the far side of the Aar.

Notable modern buildings are the Federal Houses of Parliament, the University of Bern (founded 1834), and several museums and libraries. Near the Houses of Parliament is the famous monument of the Universal Postal Union, which was organized in Bern in 1874 (for picture, see Postoffice). Among the other international organizations which make Bern their headquarters are those dealing with world problems of telegraph services, railways, and copyrights.

An abundant supply of milk from dairy farms near by makes Bern an important producer of chocolate and condensed milk. Other industrial products are machinery and scientific instruments. The Aar has been dammed to generate electricity.

Bern was founded in 1191 as a military post and entered the Swiss Confederation in 1353. Fire destroyed most of it in 1405. It became the capital of Switzerland in 1848, and is also the capital of the canton (state) of Bern, which has a population of about 690,000. Population of city, about 112,000.

BETEL. A preparation of the nuts of the betel palm (*Areca catechu*) has been the "chewing-gum" of the people of the Orient for at least 2,500 years. Nearly one-tenth of the human family practice betel chewing and in the East Indies, where this drug habit is most general, nearly every native man and woman, young and old, carries a betel box.

The kernel of the nuts, which are about the size of a small hen's egg, is prepared by boiling, drying, and slicing. A small piece is placed on the leathery leaf of a vine belonging to the pepper family (called "betel

vine"), together with a bit of quicklime, and the whole is rolled into a pellet. When chewed the pellets have a sharp, stinging, peppery taste, color the saliva brick red, stain the gums and lips, and blacken the teeth. Many betel chewers are toothless at the age of twenty-five. In India the betel chew is usually called *pawn*.

BETHLEHEM. At the foot of a hill in Palestine thickly covered with vines and olive trees, slumbers the peaceful little town of Bethlehem, which shares with its near neighbor Jerusalem the distinction of being the most sacred spot in Christendom. At the end of its long straggling street, lined with low, flat-roofed houses, is the shrine to which millions of pilgrims have turned their steps—the magnificent Church of the Nativity erected, in 327, over the grotto where Christ is believed to have been born. The nave of this beautiful and interesting church which monarchs have vied in adorning is said to be the oldest monument of Christian architecture in the world. In the grotto below, a marble trough marks the traditional spot where the manger-cradle stood. A famous altar, called the Altar of the Innocents, marks the reputed burial place of the 2,000 children who, according to the New Testament account, were slain by Herod.

But even before the birth of Christ, Bethlehem was a place of great fame, for it was the scene of the romance of Ruth and of the death of Rachel. It was also the birthplace of David, and in it he was anointed king by Samuel. Population, about 8,000.

The BIBLE, the WORLD'S BOOK of BOOKS

*How the Marvelous Jewish and Christian Scriptures Have Come to Us
Across the Centuries and, Though Written in Ancient Tongues,
Still Speak to All the Language of the Soul*

BIBLE. In a narrow cell in a monastery of England, nearly 1,200 years ago, lay the Venerable Bede, the most famous scholar of his day in Western Europe. Feebly he dictated his translation of St. John's Gospel, for although desperately ill he would not rest from his labors.

"Go on quickly," he commanded the scribe. "I know not how long I shall hold out or how soon my Master will call me hence." All day long they worked, and when the rays of the setting sun glided into the quiet room, the task was almost done.



The Venerable Bede Dictating the Last Words of St. John's Gospel to the Young Scribe.

"There remains but one chapter, master," said the anxious scribe. "Will you not rest now?"

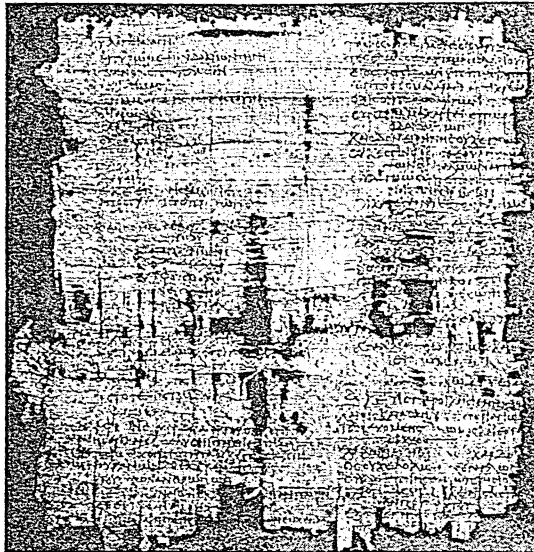
"Nay, we must go on," Bede replied. "Take up thy pen again and I will translate."

His eyes blinded with tears, the young scribe wrote on. "And now, father," said he, as he set down the last sentence from the quivering lips, "it is

finished."

"Ay, it is finished," echoed the dying Bede. And turning his face to the window where he had so long worked and prayed, he died.

ANCIENT MANUSCRIPTS OF THE BOOK OF BOOKS



On the left is a piece of papyrus containing part of the Twelfth Psalm in Greek translation. This is one of the earliest existing manuscripts of any portion of the Bible. On the right is a page from the treasured Codex Sinaiticus, a 4th-century Greek manuscript on vellum, in the British Museum. The pages of this manuscript were found in a monastery near Mount Sinai in 1844 and 1859.

This saintly scholar is only one of the many great men who have given their lives that the world might have the Bible, the sacred book of Christianity. This great book has woven itself into the very life of the Christian peoples. Translated into Latin, its lessons were the basis of all the church services of the Middle Ages. That its message might be available for the heathen Teutons and Slavs, Ulfilas devised the Gothic alphabet and Cyril the Russian. An English translation of the Bible was the chief treasure of that little band of Puritans who set sail for America to find "freedom to worship God" in their own way. It has been on every battlefield since the printing press made it available to all. Explorers have carried it into the frozen North and into the heart of the tropical jungles for consolation on their hard journeys; and missionaries, many times at the cost of their lives, have brought its message to heathen lands.

The Book that is Really a Library

But the Bible is more than our great sacred book; it is also our greatest literary heritage. There is no other book worded with more haunting beauty than our English Bible. Merely as literature, it has made a deeper impression upon the human mind than has any other book, and the extent to which it has helped shape the world's ideas cannot be estimated. No matter how much you may know of poetry and prose, you cannot consider yourself well read unless you are thoroughly acquainted with the Bible. It is a library rather than a book, for it is a collection of 66 books, each distinct in itself, abounding in literature of the highest type. Almost every phase of life and thought is dealt with, and every form of literature is included in its pages—stories, biographies, letters, orations, prayers, hymns of praise and thanksgiving, fierce war songs, tender love lyrics, fables, proverbs, epigrams,

genealogies, and chronologies. The vigor and dramatic force, the beauty and grandeur, of some of these books have not been excelled in any other writing.

The Bible has two great divisions, the Old and the New Testament. Testament means "covenant" or mutual understanding—a covenant between God and His people.

The Old Testament and the New

The Old Testament is the record of the history and religious literature of a little band of people, the Jews, who believed in one God who was loving and just. All about the little country of Palestine were great and powerful nations, who worshiped many gods, but Israel held fast to its monotheistic belief. In the New Testament is the story of the life of Jesus and his teachings, and the acts and epistles of the Apostles. All through the Old Testament are promises that God would give His people a deliverer; and these promises, which Christianity teaches were fulfilled in the life and death of Jesus, give the thread of unity binding the Old Testament to the New.

One of the most wonderful things about this wonderful book is the way it has been preserved through the ages, and the way its narratives are supplemented by the records of the mighty empires which surrounded the little country of Palestine—Babylonia, Assyria, the Persians, the Hittites, and the Egyptians.

The Old Testament was written in Hebrew (except for a few passages in the related Aramaic dialect), and the New Testament in a popular form of Greek and in Aramaic. Into every country where Christianity spread, the Bible was translated into the language of that country—first into various Eastern dialects, then into Latin, the language of the Romans, and then into the languages of Western Europe. No

other book has been translated into so many languages. The whole of it has been translated into 108 languages, and parts of it into more than 500. The greatest of the early translations was that into Latin made by St. Jerome, who lived about 400 years after Christ. This translation, known as the Vulgate, is today the official Bible of the Roman Catholic Church throughout the world. It was also the basis of the earlier translations into English and other European tongues, and of the Douai English translation which is used by English-speaking Catholics. It is an interesting commentary on the interest taken in the Bible that when printing was invented in the 15th century, the Latin Bible was the first complete book printed.

Parts of the Bible were early translated into English. The first writer to do this was Caedmon, though it is true he did not translate the Bible at all in the usual sense, but sang its divine stories so the ignorant people of his time could understand them (see Caedmon). Other translators, including Bede, gave the peoples of England fragments of the scriptures in their own tongue, but it was not until the year 1382 that the whole Bible was translated into English.

Famous Translations of the Bible

This first English Bible, translated from the Latin Vulgate (1382) and copied out by hand, is considered by many to be the work of the group of early reformers headed by John Wyclif and bears his name. Great opposition arose to it because its authors were "heretics" and translated many passages in a sense not approved by the church. Nevertheless, it was so widely circulated that, in spite of the fact that its reading was prohibited by law, there are more than 100 manuscript copies of it preserved today.

William Tyndale, who was born a hundred years after Wyclif's death, went back to the original Hebrew and Greek versions, and his translation of

many passages is so good that much of it is preserved in the English Bible of today. But Tyndale too was a "heretic," and when the first of his books reached

England from the Continent they were burned as "pernicious merchandise." The new art of printing, however, spread his Bible far and wide. In the end Tyndale was condemned as a heretic on the Continent and he became one of the martyrs for the Protestant faith.

Miles Coverdale's Bible (authorized in 1535) was founded in part on Tyndale's translation; while the "Great Bible," ordered by Henry VIII in 1539 to be placed in all the churches, was partly based on Coverdale and partly on the work of John Rogers, later a martyr.

When James I came to the throne, the Reformation had been established in Great Britain and the church services were

all in English. He desired an English Bible more perfect than any then existing, so he instructed 47 biblical scholars to prepare a new translation. The result of their labors was the King James Version, published in 1611, which has been for 300 years the "authorized version" of the Protestant English-speaking people. It is the greatest book in the English language. "Its simple majestic Anglo-Saxon tongue," says one writer, "its clear sparkling style, its directness and force of utterance, have made it the model in language, style, and dignity of some of the choicest writers of the last two centuries, and its reverential and spiritual tone and attitude have made it the idol of the Christian church and endeared it to the hearts of millions of men and women."

For English speaking Catholics a similar place is held by the Douai Version. This was first produced at the University of Douai, in France, by Catholic refugees from England in Elizabeth's day. Dr. Gregory Martin, formerly of Oxford, played the chief part in the translation, which was revised by William Allen and others. The New Testament was published in 1582, and the whole Bible in two volumes in 1609 and 1610.

A HEBREW SCHOLAR READING FROM A SCROLL



Seated with a scroll before him, this venerable old man with the white beard is studying in the original Hebrew the faith of his fathers as recorded in the Old Testament. The scroll is unrolled with one hand as he follows it page by page, and rolled up with the other.

The Revised Version, made desirable by the discovery of new manuscripts, was published in 1885 by a committee of English scholars coöperating with a similar committee appointed in the United States. Its translations are more accurate, but it lacks the beauty of language of the King James (or Authorized) Version.

In the early Christian Churches,—at Ephesus, Jerusalem, or Rome—say 50 years after the death of Jesus, the church services were secret because the Christian worship was forbidden by the law of the Roman Empire. After preliminary prayers and singing, amid a rustle of anticipation, the leader would turn to a great chest hung with silken curtains. Many scrolls of writings were in this chest, among them the sacred writings of the Jews, copies of letters from Fathers of the new church, and writings of Christ's own Apostles. If we could understand the ancient language, the passages read would all sound very familiar to us, for we have heard them over and over again in our churches and Sunday-schools. These scrolls or *biblia*, which is the Greek word for "books," have almost all been lost for hundreds of years. But before they were lost or destroyed, copies and translations were made of them, and from these was put together our Bible of today.

Establishing the "Canon"

The Old Testament as we know it is by no means the whole of the sacred writings of the Jewish people. It was not until 200 years after Christianity had been founded that the rabbis and teachers of the Jews finally decided which of their books should be regarded as "canonical" in the Jewish church. "Canon" means literally a rule or measure, and applied to the Bible it means a list of books which were accepted as inspired. These "canonical scriptures" of the Jews became the Old Testament of the Christians. But the early Christian church put 14 of these rejected books in a separate group at the end of the Old Testament. These we call the *Apocrypha*—the Greek word for "hidden," or the "hidden books." The Roman Catholic church still uses these Apocryphal books, but the Protestant churches do not recognize them. They include the books of Tobit, Judith, the remainder of Esther, the remainder of Daniel, the Wisdom of Solomon, Ecclesiasticus (called 'The Wisdom of Jesus, the son of Sirach'), Baruch, I and II Maccabees. All the leading English translations down to the King James Version included these books, and the scholars who gave us the Revised Version revised these books with the rest, although they were published in a separate volume. Some of the passages are equal in nobility to passages from the books included as inspired. Examples are: "Truth abideth and is strong forever; she liveth and conquereth forevermore" (I Esdras). "The souls of the righteous are in the hands of God . . . in the eyes of the unwise they seem to perish, but they are in happiness" (Tobit).

Similarly there was for a long time a difference of opinion as to what books should be included in the New Testament. There are no less than 109 of the New Testament apocryphal books, whose very names are unfamiliar to most Christians today; examples are the Epistle of Barnabas, the Teaching

of the Twelve Apostles, and the Shepherd of Hermas. The canon of the New Testament was not decided until 382 A.D. at a council of the church held at Rome.

The oldest manuscripts of the collected books of the Bible go back only to about 350 A.D. There are only a few of these and they are carefully guarded in libraries and museums. The oldest one of which we know is the Vatican manuscript, kept in the Vatican Library at Rome, which contains almost the whole of the New Testament in Greek. The Sinaitic manuscript, of about the same date, contains all the New Testament and part of the Old. This was found in 1844 in a monastery at the foot

of Mt. Sinai. It is now in the British Museum, which paid about half a million dollars for it in 1934. The British Museum also has the Alexandrine manuscript, of the 5th century, which contains most of both the Old and New Testaments.

Some of the old Bible manuscripts are "palimpsests," so called because the original writing on the parchment sheets had later been erased so that the sheets could be used for other writing. By using chemicals and photography scholars can make much of the original contents legible.

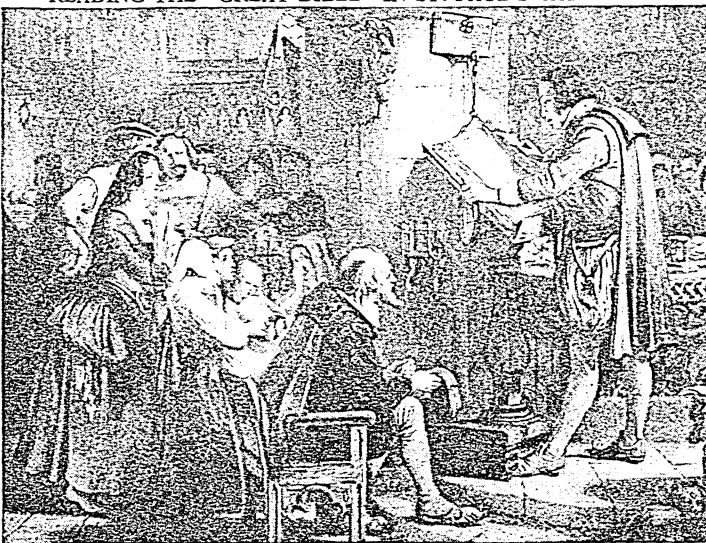
The New Testament was written in Greek. There are nearly 2,000 ancient manuscripts of the whole or different parts of the New Testament written in this language, but none is older than the manuscripts described above. In recent years, however, in excavations made in Egypt, there have been found several pages containing "sayings of Jesus," which are probably a full century or more older than the oldest New Testament manuscripts we have. These priceless fragments of waste paper found in the shifting sands at the edge of an Egyptian town contain some teachings of the Master which are not recorded in the books of the New Testament as they later took shape.

The work of comparing such early manuscripts and correcting the text and revising the translation has gone on from early days. When the Temple at Jerusalem was burned in 70 A.D. much of the sacred literature of the Jews was lost; but a school of rabbis was formed at Tiberias to restore it. Alexandria in Egypt early became a center for the study of the Christian writings. All through the Middle Ages patient monks busied themselves with the labor of copying and so preserving the sacred texts. And with the publication of the printed Greek text of the New Testament by Erasmus in 1516, and by the Spanish cardinal Ximenes in 1522, the modern study of the Bible began.

Some Notable Bibles

One of the most beautiful of the Bible manuscripts in existence is a translation into Gothic by Ulfilas, the missionary to the Goths, which is now preserved in Upsala, Sweden. It has silver letters on purple vellum.

READING THE "GREAT BIBLE" IN ST. PAUL'S CATHEDRAL



This scene takes us back to 1539, when the new English translation of the Bible made by Miles Coverdale at the direction of Archbishop Cranmer and Lord Thomas Cromwell, and issued under the authority of King Henry VIII, was ordered placed in all the churches of England. The picture shows the eagerness with which the people availed themselves of the privilege to read and interpret the Bible for themselves.

The 42-line Bible, on which Johann Gutenberg, with the support of Johann Fust, worked from 1450 to 1455, was the first important book printed from movable type. It is sometimes called the Mazarin Bible, because the first copy described by bibliographers was found in the library of Cardinal Mazarin in Paris. There are 38 known perfect copies printed on paper and only three perfect specimens printed on vellum. One of the latter, for which a famous collector paid more than \$350,000, is now in the Library of Congress. The Bibliothèque Nationale has another, and the British Museum the third.

The "Complutensian Polyglot," published by Cardinal Ximenes in 1522, prints the Greek of the New Testament in one column and the Latin of the Vulgate in the other. For the Old Testament it gives the Hebrew on one side, an old Greek translation (called the Septuagint) on the other, and the Latin Vulgate between—"like Christ crucified between the two thieves," so the preface to the work remarks.

The "Bug Bible" (1551) was so called because of the translation of Psalms xci, 5, which read, "afraid of bugs by night," instead of our present reading, "terror by night."

The "Breeches Bible" is an English version published at Geneva in 1560, and is named from its translation of Gen. iii, 7, which reads, "making themselves *breeches* out of

fig-leaves." The "Wicked Bible," printed in England in 1681, left out the word "not" in the Seventh Commandment. For this error the unfortunate printer was fined the equivalent of \$1,500 in present-day money.

The "Thumb Bible," published in 1670 at Aberdeen (Scotland), measured only one inch square and one-half inch thick.

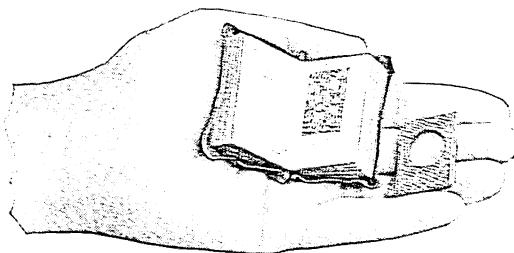
The "Vinegar Bible" (1717) has as the heading of the 20th chapter of Luke "The Parable of the Vinegar" instead of "the vineyard."

The "Devil's Bible" is the name given a manuscript of the Bible taken to Stockholm after the Thirty Years' War. It is beautifully written on 800 asses' skins, and legend says it is the work of a monk condemned to death, who by selling himself to Satan was enabled to save his life by meeting the condition that he should copy the whole Bible on asses' skins in one night.

The Caxton Memorial Bible was wholly printed and bound

in 12 hours, in 1877, to celebrate the 400th anniversary of the introduction of printing into England.

One of the smallest bibles in the world was printed in Glasgow in 1901. Without the cover it is seven-sixteenths of an inch thick. It has 876 pages and several illustrations. A magnifying glass slips into a pocket in the cover.



This is the little Bible referred to in the text. It measures, without the cover, 1½ inches by 1¼ inches, but you can read it very plainly by using the magnifying glass.

How Scholars CLASSIFY BOOKS to Meet ALL NEEDS

BIBLIOGRAPHY. There are said to exist in printed form about eight and a half million separate writings, each long enough to be called a book. No one can, of course, read more than a few thousand of them in the course of his lifetime. It is therefore important that he select for his reading the books which will best serve his particular needs. Bibliography is an apparatus designed to assist him in making his selection. These eight and a half million books record the most important things which men have done and felt and thought. Any person can turn to this printed record and draw upon the stores of knowledge accumulated by past generations in much the same way that he can recall his own past experiences. In one sense our books, taken as a whole, form the memory of the whole human race. Bibliography is the key to this memory. It is a switchboard that connects the person who wants a particular kind of book with the available books of that character.

Our word "bibliography" comes from two Greek terms meaning "book" and "writing." Thus in the broadest sense any literary composition about books might be called a bibliography. In ordinary use, however, the word has a narrower meaning; usually it is applied only to instructive lists of books.

Not every list of books is a bibliography. A bookseller's inventory of his stock is a catalog but not a bibliography, because it is primarily concerned with neither the authorship nor the textual content of the volumes which it enumerates. A bibliography must include the element of intellectual purpose. In short, it must be adapted for use as a working tool.

Whether it is called a bibliography or a handbook or a guide or an encyclopedia, every book is a bibliography if it contains a systematic list of books which may serve for a particular purpose. Necessarily there are all sorts of bibliographies to meet all sorts of different needs. There are author bibliographies, as for example, a list of all the writings of Charles Dickens; subject bibliographies, such as lists of useful books about chemistry; bibliographies of literary form like lists of one-act plays; local bibliographies such as a list of the works of the New England poets; period bibliographies, like lists of the literary productions of the Age of Elizabeth; language bibliographies, as a list of books written in Spanish. There are even bibliographies of bibliographies.

The value of any bibliography depends upon four different elements: the knowledge of the person who compiles it; the extent to which he imparts that knowledge; the ease with which his book can be used; and its accuracy in detail.

The best bibliography on any subject is one written by a specialist in that field. Usually a select bibliography of the best books, when compiled by such a person, is more useful than one listing all the available literature of the field.

For the convenience of the reader, a good bibliography distributes its subjects under logical subdivisions. A reader seeking books about Shakespeare will find little help in a single list of all the books about all the English dramatists. Indeed, if what he wants is only definite information about Shakespeare's education, a complete list of all the books about

Shakespeare, arranged in one alphabet according to their author's names, will be equally useless. A bibliography should divide and subdivide its subjects until only a few books are included under each topic, and arrange these topics so logically that a reader can turn quickly to the particular section he wants.

The Importance of Accuracy

The bibliographer must also be accurate. When he mentions a book he must do it in such a way that his reader can be certain of just what book he means. For this purpose he will do well to use the conventional system which has proved well suited for the purpose. This system records certain facts about each book which may be regarded as the indispensable elements of detailed bibliographical description. In their simplest form these are: author, title, place of publication, date of publication, and size of the book. All except the last of these elements appear on the title page of every ordinary book. Although they are simple facts, a beginner sometimes has trouble with the first, second, and fifth. In the citation, each author must be distinguished definitely from all other persons bearing the same name. Family names alone are therefore insufficient. To refer to a particular person his full name (or at least his initials) must always be given. Where even this is not completely distinctive, it is customary to add the birth and death year of each individual. The same general principle will govern the form used for recording the title of a book; enough must be given to prevent any possible confusion. Where the title is unusually long, non-significant words may be omitted, and the omission indicated by the conventional *hiatus* sign (three dots) on the line of the writing. In the record of size conventional usage varies. Usually approximate indications are sufficient. It makes little difference to the ordinary reader whether a book contains 272 or 288 pages. It makes a great difference whether it is a slender pamphlet or an extensive treatise in many volumes. Similarly most readers will want to know whether a book is a portable volume or the size of an atlas.

On the other hand, every reader and collector will desire assurance that the book he is using is not incomplete. If his volume lacks an important preface, illustrative plates and maps, or index, he will prefer to discard it for a complete copy. If he is in doubt he may consult the *collation*, or exact list of parts which this book ought to contain. To record all these facts, various devices are used. Each bibliographer will select the one best adapted to his purpose. The following typical examples will bring out the differences between meager and elaborate forms of bibliographical record. The principal difference, it will be noted, lies in the details of collation.

Defoe, Daniel.

... Robinson Crusoe ... N. Y. 1923. 362pp. 8°.

Defoe, Daniel.

The life and surprising adventures of Robinson Crusoe of York, mariner. New York, Harper, 1923. 5p. l., 362, [1]p. incl. illus., plates, col. front., map. 23½ cm.

These two descriptions of the same book illustrate the difference between simple and complete records. The abbreviations in the collation read: five preliminary leaves; 362 numbered pages, plus one unnumbered page, including illustrations and plates; colored frontispiece, and a map. The volume is 23½ cm. (9¼ inches) high.

For a book written by a single author these five elements are usually sufficient, but many books are of such a character as to introduce complications which must be provided for in the scheme of bibliographical description. Some books are enlarged or revised by their authors in successive editions. Whenever this is done the bibliographer must distinguish the text that he cites. Other books are written by two or more authors working together. Still other books are reissued after the death of their authors and various changes made by their editors: obsolete spellings may be corrected, modern punctuation introduced, footnotes added, certain passages omitted, and new ones introduced. Other books may be illustrated so beautifully that the pictures are more important than the text. The bibliographer must always add to his record the names of all persons who contributed in a constructive way to the production of the book in the form in which he has it. Usually he will also make a separate citation under the name of each of these secondary contributors. Citations of this kind are technically known as added entries.

There are also many books which are compiled or issued, not by individuals but by organized bodies. Such books the bibliographer describes as of corporate authorship. These are of various sorts, but most of them are official publications of governmental bodies, laws, debates, decisions, and reports of federal or local legislatures, courts, departments, commissions, and bureaus. National academies and other learned societies also contribute a large mass of corporate literature through the publication of their transactions, contributions, and reports. Even where the writer of a particular publication of this kind is known, it is customary to cite the body that authorized it as the corporate author, with a cross-reference from the name of the person who actually did the writing.

Serials and Periodicals

Still another variation from the simple formula is necessary in a reference to a writing which has appeared as a part in a serial publication. Some serials are published irregularly as the parts are completed. These are variously entitled "Collections," "Libraries," and the like, by their publishers. Successive parts usually bear only the year of their publication. This form of date will ordinarily distinguish "serials" from "periodicals"; these latter appear at regular intervals and are dated with the month or day of their appearance. Today much of our most important current literature appears in the form of periodical publication. The following examples illustrate the description, first, of material published in periodical form, and second, of a serial item:

Pollock, James K.

The Position of the British Parliament. In *American Political Science Review*, XXV, 688-688, Aug. 1931.

United States—Office of Indian Affairs.

Bulletin 4. Holmes, W. H. . . . Indian Art and Industries. Washington, 1922.

The General Reader and Bibliographies

Because the interests of individual readers are so varied and bibliographies are so numerous, it is impossible to compile a generally useful brief list. A useful bibliographical tool for a home library is *The Bookman's Manual: A Guide to Literature*, compiled by Bessie Graham and published by the R. R. Bowker Company. A new edition of this manual is published every few years.

Most large public and college libraries have extensive collections of bibliographies. To aid the student in finding them, cards are filed in a card catalog, which indicate the bibliographical material available on any subject. Larger libraries also provide such tools as the 'Bibliographical Index' which is published quarterly and in cumulative annual volumes.

Even the smaller libraries provide some standard bibliographical tools which are available to the general public. Among these is the 'A.L.A. Catalog', published by the American Library Association, which arranges by subjects the best and most useful books. Equally authoritative is the Standard Catalog Series published by the H. W. Wilson Company. This series devotes separate volumes to general fields of knowledge, such as biography, fine arts, science, and useful arts. In this series are 'The Children's Catalog' and 'The Standard Catalog for High School Libraries', which list in subject arrangement the best books for children and young people.

Librarians and Bibliographies

Every librarian by the very nature of his profession must be something of a bibliographer. A reader frequently asks for advice in his selection of books, and short bibliographies must be prepared with special reference to his needs. For this advisory work larger libraries designate special staff members who are known as "readers' advisers." These librarians work with study groups and clubs as well.

Every professional organization of librarians devotes some attention to bibliographical problems. Many librarians are also members of the Bibliographical Society of America. This society serves as a clearinghouse for bibliographical enterprises, coordinates the work of its members, and publishes contributions to the advance of the science.

Carefully selected bibliographies covering the major fields of knowledge accompany the Reference-Outlines in this encyclopedia. Since these lists of books contain only the most useful current works, the librarians who compiled them have not attempted to give a full bibliographical description of each work named. A list of these bibliographies will be found in the FACT-INDEX under Bibliography.

BICYCLES AND MOTORCYCLES. The title "father of the bicycle" is usually given to a German, Karl Drais, who in 1816 invented a "velocipede." The rider of this machine rested his weight upon the frame and

moved by kicking the ground with his feet. Not until 1865 was the rotary-crank-driven velocipede invented. In France. In England, about 1868, belongs the credit of producing the first steel-framed, solid-rubber-tired machine—now named "bicycle"—which superseded the iron-tired "boneshakers" of earlier days. (For picture, see Transportation.)

In the early bicycles "ordinaries" they were commonly called, the pedals operated directly on the front wheel, and so the front wheel was very large, and the back wheel was simply a small steering wheel. In the early 80's the front wheel was 40 and even 44 inches high. These wheels were difficult to mount and ride. The "star" bicycle with the little wheel in front was introduced in 1883.

The "Safety" Bicycle Invented

In the early 1880's the bicycle "came down to earth," and the low, or "safety," machine took the place of the old high machine. This was made possible by using a sprocket-and-chain device to drive the rear wheel. Soon after this came the invention that made the bicycle really popular—the easy-riding pneumatic tire. Ball bearings and the spring saddle were later improvements. The coaster brake and "free wheeling" increased safety and comfort. This device operates by temporarily disengaging the rear wheel from the sprocket and chain by means of an overrunning clutch, thus permitting the wheel to turn independently while the pedals remain at rest. A slight backward motion of the pedals applies the brake. The modern bicycle has many other safety devices, but safe riding depends ultimately on the rider (see Safety).

In the United States, bicycle riding was most popular during the late 1890's, reaching the height of its vogue about 1899. When the automobile came in, this popularity declined, though the bicycle continued to be used for delivering messages and parcels, as well as for sport and racing. Soon after 1931, young people again took to riding them and sales greatly increased. The automobile tire shortage in the United States in the second World War brought about renewed use of the bicycle by adults. In Europe, bicycles have always outnumbered automobiles.

Bicycles with Motors

The motorcycle is a bicycle propelled by a gasoline engine. The first machines, which were introduced about 1894, were equipped with one-cylinder motors, but they now have two- and even four-cylinder motors. Motorcycles are used in traffic police work and for commercial deliveries, as well as for sport. They are sometimes equipped with a sidecar for an extra passenger or for goods. "Scooters," which are small gasoline-driven vehicles developed from the familiar home-made device used by boys, have attained some commercial importance.

Both bicycles and motorcycles are of considerable military value. Motorcycles are used not only by dispatch riders but also by motorized infantry. To conserve gasoline, some armies, especially the German and the Japanese, have used bicycles extensively.

BIGHORN. In the early days the wild sheep called the bighorn or Rocky Mountain sheep ranged throughout the whole western mountain system of North America, from Alaska to New Mexico. They are becoming rare, but may still be found in the rocky plateaus of the Bad Lands of Dakota, and in greater numbers about the headwaters of the Yellowstone and thence northward.

The massive circling horns of the male, which give the animal its name, are coveted as trophies, and much skill and patience on the part of the hunter are needed to capture this wonderfully swift, agile, and tireless animal. Its flesh is generally considered to be the best of all western game. In most states, the bighorn is now protected by game laws. The color is tawny yellow in summer, changing to grayish-brown in winter. It is a sturdily built sheep, about 40 inches in height and sometimes weighing as much as 300 pounds. The horns often measure 42 inches or more in total length.

The bighorn must not be confused with the Rocky Mountain goat, or white goat, which is an entirely different animal. Scientific name of the bighorn, *Ovis canadensis*.

BILLIARDS. No other game in the world requires such delicacy of touch, steadiness of hand, accuracy of eye, and iron self-control as the ancient game of billiards. Long practice enables the skilful player to control the motions of the balls with an accuracy that seems almost miraculous to the beginner. In fact, the really expert can do feats so far out of the ordinary man's reach that the English philosopher Herbert Spencer once remarked that to play billiards well was the mark of an ill-spent youth. Spencer enjoyed the game thoroughly, however, and was accustomed to relax his mind after a morning of hard work by an hour of billiards at his club.

The game has been played in many different ways at various times, and even today there are marked differences between the English, French, and American games. In America billiards is played on a table usually ten feet long and half as wide, having a very

smooth and level surface of slate covered with green baize. Around the edge of the table is a beveled rail cushioned with rubber, from which the balls rebound lightly and easily. Three ivory balls $2\frac{3}{8}$ inches in diameter are used, one of which is red and the other

two white. One of the white balls is distinguished by a tiny black spot. Each player chooses one of these white balls as his "cue" ball. This cue ball is driven by a cue, a leather-tipped wooden rod a little less than five feet long and varying in diameter from half an inch or less at the point to an inch or an inch and a half at the butt. Chalk is rubbed on the leather tip every few turns to make greater friction between cue and ball, thereby better control.

With the fingers of one hand the player holds the butt of his cue firmly but lightly; the other hand he places on the table so that the forefinger and thumb support and guide the forward part of the cue. The cue ball is struck with the point of the cue in such a way as to cause it to touch first one and then the other of the two remaining balls, thus making a "carom" or "billiard." Each billiard

counts one point in the score. By directing the point of the cue against a part of the cue ball to one side or above or below its center, it is possible to "put English" on the ball; that is, to make it twist or curve and thus make shots otherwise impossible.

One very effective way to score many points without missing is to "nurse" the balls; that is, to get them in a corner or along the rail and by hitting them very lightly hold them in one place for a long time. This easy way of running up a large score is made impossible in many professional games by marking "balk lines" 14 or 18 inches in from the edges of the table, and by making the rule that either every second or every third shot must be hard enough to send at least one of the balls outside the marked square in which the balls are grouped when the shot begins. Any number of caroms are allowed in the square left in the center of the table.

BIGHORNS AT HOME



The Bighorn ram is a stately creature with massive coiled horns. His graceful mate is smaller and her horns are less impressive. In early spring they migrate over the roughest mountain crags to the timberline, where one or two young are born. The pair pictured here are lean and shaggy after a hard winter.

"Pocket billiards" or "pool" is quite a different game. It is played on a table that has pockets in each corner and two extra ones in the center of the longer sides. In "straight" pool, the most popular of the many pool games, 15 balls and a cue ball are used. The players take turns using the same cue ball, the object being to put the 15 balls in any of the pockets. The player wins who pockets the greatest number. In this game the player must announce what ball he is playing for, and in which pocket he intends to place it. In "rotation" pool the balls are numbered and must be played in rotation.

BILL OF RIGHTS. The English Bill of Rights was passed by Parliament in 1689, when William and Mary were brought to the throne by the "Glorious Revolution." It declared illegal the tyrannies of James II, and guaranteed to the people a fair trial in the courts, frequent meetings of Parliament and freedom of debate therein, freedom from taxation except by Parliament, the right of petition, etc. Several of the first ten amendments to the Constitution of the United States, including the one forbidding "excessive bail" and "cruel and unusual punishments," were taken almost word for word from this English Bill of Rights.

Following the example of Virginia in 1776, most of the states of the Union today begin their constitutions with a bill of rights setting forth the rights which the state may not take from the individual.

The most important statement of such rights is the Declaration of the Rights of Man issued by the French Revolution in 1789. It laid down the principle of the freedom and equality under the law of all citizens and the sovereignty of the people, as well as the rights of the individual to freedom of speech, of religion, and of the press. It has well been said that it "laid down the principles of modern governments." This declaration became an important factor in the growth of world democracy thereafter.

BIOCHEMISTRY. The most marvelous chemical laboratory is the body of a living creature. In the countless tiny cells of every plant or animal, chemical changes are constantly taking place, so wonderful and complex that they are at once the joy and the despair of the chemist. The study of the processes of life's laboratories is one of the newest and most fascinating fields into which chemistry has entered. Students of the subject in its broadest sense call this science biochemistry; others, more interested in the medical aspect, call it physiological chemistry; but the field is much the same—the chemistry of living matter.

The first step in studying the chemistry of life is a knowledge of the nature of protoplasm, the substance of which all living things are made (*see* Protoplasm). The chemical elements found in protoplasm are also found in inorganic matter. No element is peculiar to life, but 12 are indispensable: carbon, hydrogen, oxygen, nitrogen, phosphorus, sodium, chlorine, magnesium, iron, sulphur, potassium, and calcium. Sometimes protoplasm contains other ele-

ments also. Silicon, for example, gives rigidity to certain plants, and iodine and bromine occur in seaweeds in quantities sufficient for profitable extraction. These chemical elements combine to form the four great groups of organic compounds—proteins, carbohydrates, fats, and lipins—as well as organic substances known as enzymes, inorganic salts, and water.

The Building Stones of Life

Proteins are complex compounds of carbon, hydrogen, oxygen, and nitrogen. Nearly all contain traces also of sulphur and phosphorus, and sometimes of magnesium and iron. The protein molecule is very large. Casein, for instance, the characteristic protein of milk, has the approximate formula $C_{70}H_{1100}O_{160}N_{180}S_4P_4$. How different from the simple formula for water, H_2O ! The structural units of the protein molecule are known as *amino acids*, which are organic acids containing nitrogen in an amino group (NH_2). At least 30 different amino acids are known. Combined in varied amounts and groupings with one another and with other molecules they form many different kinds of proteins. So important are these acids that they have been called the building stones of life. The fibrin found in clotted blood, the myosin of muscles, and the gelatin of bones are examples of protein. (*See* Proteins.)

Carbohydrates, as the name indicates, are compounds of carbon, hydrogen, and oxygen. They comprise starches, sugars, cellulose, gums, and many other substances. Carbohydrates combine readily with oxygen and serve as the fundamental sources of energy in living things.

Fats and lipins are organic compounds greasy to the touch and capable of being dissolved in ether, alcohol, and chloroform. Fats are composed of the same chemical elements as the carbohydrates, but contain much less oxygen in proportion to the carbon. Butter, lard, and olive oil are examples of fats (*see* Fats and Oils). Lipins are similar to fats, but contain phosphorus and nitrogen, or nitrogen only, in addition to carbon, hydrogen, and oxygen. The commonest member of this class is lecithin, which occurs in all cells, and especially in nervous tissues.

Mysterious Helpers that Defy Analysis

Enzymes are organic substances of unknown chemical composition which play the part of catalysts in life processes. Catalysts are agents that cause or hasten a chemical reaction without appearing among the end products of the reaction. All cells produce enzymes, but some, the gland cells, specialize in this production and send forth enzymes to take part in external reactions, as in digestion. (*See* Enzymes.)

The *inorganic salts* contained in protoplasm are chiefly sodium and calcium chloride, with other minerals similar to those found in sea water. These salts are held in crystalline solution by water, which constitutes 60 to 90 per cent of protoplasm. Ionization of the dissolved salts is responsible for the electrical activity of protoplasm (*see* Electrochemistry). Physically, protoplasm is a colloidal system. The watery

solution acts as the dispersion medium for the finely divided masses of proteins, carbohydrates, fats, and lipins. (See Colloids.)

Knowledge of the chemical structure of protoplasm is essential for the understanding of *metabolism*, which is the sum total of all the chemical changes taking place in the cell. Those reactions by which protoplasm is built up are grouped under the term *anabolism*. In view of the chemical nature of this living substance, it is clear that proper food for the organism must contain those same elements or compounds. In addition it must have those marvelous substances called vitamins. The sources and composition of foodstuffs make up the second chapter of biochemical study. (See Food; Vitamins.)

But complex food materials must first be chemically changed into simpler compounds and rendered soluble so that they can be absorbed by the cells. This process is *digestion*. Here again the biochemist finds a vast field of study (see Digestion). The next inquiry concerns itself with assimilation, that is, how the nutrients that have been absorbed by the cells are combined to form protoplasm.

Metabolism also includes those reactions by which the constituents of protoplasm are chemically decomposed for the transformation of energy and the production of heat. These activities, grouped under the term *katabolism*, are in the nature of oxidations, that is, reactions in which oxygen unites with compounds of the protoplasmic system. Oxidations provide heat and energy for doing work; they furnish the power for the living machine (see Oxygen).

Putting the Oxygen to Work

In vertebrate animals the oxygen is carried by *hemoglobin*, an iron compound found in the red blood cells. Combined with hemoglobin, oxygen is distributed throughout the body by the blood stream. But *oxyhemoglobin* is a very unstable combination, so free oxygen is promptly released to the body cells when the blood enters the capillaries. (See Respiration.)

Within the cells there is a pigment called *cytochrome*, which takes hold of the oxygen and controls it in the narrow confines of the cell laboratory. Oxygen, the workman, is now on the job. Cytochrome, the foreman, holds it there. But atmospheric oxygen is sluggish, it acts too slowly, it must in some manner be "activated." The cell is ready for this emergency with certain oxidizing enzymes, the *oxidases*, which hasten the union of oxygen and assimilated foods.

The process of oxidation in living tissues is identical with ordinary combustion (see Fire). Carbohydrates and fats are completely oxidized in the body and are the chief sources of animal energy, some of which is converted into heat. Proteins are also oxidized to a slight extent. The living fire consumes fuel, creates heat, but also leaves behind waste products of combustion. The oxidation of carbohydrates, fats, and lipins gives rise to carbon dioxide and water. In the case of proteins the end products of combustion are carbon dioxide, water, and a variety of nitrogen-

containing compounds. These products are no longer of use to the body. They are the waste materials of metabolism, the *excretions* (see Kidneys).

Another aspect of living matter is its ability to perform movements. Animal movements are due to the shortening or contracting of muscle fibers. How is this brought about? The living threads or fibers that make up muscle contain a carbohydrate called glycogen or "animal starch." When a nerve-message "orders" a muscle to contract, glycogen is changed into an intermediary substance which gives rise to lactic acid. The lactic acid by its mere presence causes the fibers to contract, and work is done. But if the muscle is to recover and do more work, the lactic acid has to be removed. Part of it is changed into the intermediary, and this into glycogen again. The remainder forms carbon dioxide and water. The muscle does not require oxygen for the immediate release of energy, but in the recovery phase oxygen is essential. The oxidation of lactic acid furnishes energy for "recharging the battery." An athlete, panting after an exhausting race, is unconsciously getting enough oxygen to burn up the lactic acid which has accumulated in his blood and tissues. In a short time his muscles are recharged with glycogen and he is ready for another race.

Chemistry Controls Our Size and Numbers

Other interesting problems from the biochemical standpoint are growth, which is increase in size, and reproduction, which is increase in numbers. Both of these life functions are under the control of internal secretions or hormones (see Gland). The formation of the hormones by various organs of the body is primarily a chemical process, and their use by the body also involves chemical problems.

Turning now to the study of plants, we find similar problems of great importance for the biochemist. By far the most important chemical reaction taking place on earth is *photosynthesis*. This is the process which occurs in plants, when, in the presence of sunlight and a green pigment, chlorophyll, carbon dioxide and water unite to form carbohydrates, and oxygen is evolved as a by-product. (See Leaves, Plant Life.) All life depends upon this process, for it makes a source of energy available to both plants and animals. It is the reaction by which organic foods are made out of inorganic materials.

Many theories have been proposed to explain the chemistry of photosynthesis. The first step in the process, according to the commonly accepted theory is the production of formaldehyde (CH_2O). This is accomplished by reducing carbon dioxide to carbon monoxide ($\text{CO}_2 = \text{CO} + \text{O}$) which unites with water to give formaldehyde ($\text{CO} + \text{H}_2\text{O} = \text{CH}_2\text{O} + \text{O}$). The free oxygen is given off. Then by rearrangement of the atoms of formaldehyde a simple sugar is formed ($6\text{CH}_2\text{O} = \text{C}_6\text{H}_{12}\text{O}_6$), which by further synthesis is converted into starch.

Once the plant is supplied with carbohydrates, it can proceed to the synthesis of other organic sub-

stances. The manufacture of proteins, fats, acids, alkaloids, etc., is dependent upon the photosynthetic mechanism. Proteins are produced by certain cells when they are supplied with carbohydrates and inorganic salts, such as nitrates to furnish nitrogen, phosphates to furnish phosphorus, sulphates to provide sulphur, and so on. Fats, consisting as they do of the same elements as the carbohydrates, originate by a modification of starches and sugars.

Plant Laboratories Keep Us Alive

Think of all the useful products that are built up in the biochemical laboratory of the plant! Not only foods for man and animal, but gums, camphors, resins, all the variety of oils and essences, rubber, alcohol, tannin, iodine, the drugs that cure our ills, quinine, atropin, and a wealth of other substances. Photosynthesis is behind all this; and plants produce the oxygen we breathe.

Let us glance for a moment at some of the methods which chemists use in attacking life problems. The chemist begins by taking apart, or analyzing, materials whose transformations he wishes to understand. He sorts out the various ingredients. He

attempts to isolate pure principles from a complex mixture. So he discovers cocaine, or insulin, or thyroxin. Then he attempts to resolve such compounds into their chemical elements. Not satisfied with this, he considers the groupings of atoms in the molecule—the smallest particle of the substance. He tries to picture the way in which these atoms are linked together. This enables him in some cases to prepare the product artificially and more cheaply.

For example, cocaine, the first drug used to produce local anesthesia, has serious drawbacks. It occurs in the leaves of the coca plant, and because rare, is expensive. Moreover it is dangerous and habit-forming (*see* Narcotics). The discovery of the exact molecular structure of cocaine led to the artificial preparation of a similar compound called procaine (also novocaine), which is just as effective as cocaine without being dangerous or habit-forming.

This, then, is the hope of the biochemist: to understand the chemical structure of life substances, to gain a knowledge of life's chemical processes, and then to imitate, control, or improve upon Nature's methods for the benefit of mankind.

The WONDERFUL SCIENCE of LIVING THINGS

BIOLOGY. If a "man from Mars" were to come to the earth, he would be surprised at two things—at the amazing wonder, beauty, interest, and variety of living things, with the "oneness" of all earthly life, and that so many people remain blind to the fascination of the

living things which surround them. In the limits of this brief article, only some of the broader aspects of the science of living things can be considered.

Biology, in brief, is "the science of life." There are at least two million *kinds* of living things in the world. With all their irreconcilable contrasts—men, earthworms, jellyfishes, oak trees, ferns, seaweeds—they yet possess many features in common. All life is fundamentally one. And so we have the common great science of biology, which deals especially with the far-reaching fundamental characters of living things.

Of course this study is so vast that it is impossible for any one man to cover or master the whole field in detail. Consequently it is broken up into divisions, of which the primary ones are *botany*, the science of plant life, and *zoölogy*, the science of animal life; and each natural scientist further specializes in some narrower line, such as anatomy, physiology, embryology, genetics, or some other of a large number of such fields. But there is still place for the

HOW amazing are the revelations of Biology, which teaches the "oneness" of Life—throughout all its more than 2,000,000 earthly forms—earthworms and jellyfishes, apes and man, oak trees and seaweed! What magic there is in the stuff "protoplasm" from which all living creatures are formed; how fascinating is the study of embryology and the laws of inheritance; and how startling it is to learn that "all the people in the world at any one time have had their heredity carried by a total of less than an ounce of matter!" Here are presented the chief facts of the science of Biology, with an indication of its chief lines of advance in the past hundred years.

common science of biology, to take account of living things especially in their larger relations, and to correlate all of the many divisions of the subject.

The modern science of biology differs from the old-time "natural history" chiefly in that the latter was, in the main,

a great accumulation of disconnected facts about plants and animals. Biology, on the other hand, takes account of the detailed facts mainly as they illustrate the principles and laws that govern life. At present the term natural history is customarily used to apply especially to the out-of-doors study of the habitats, habits, modes of life, seasons, and activities of living things, both plants and animals. While this outside study of living things has its wonderful fascinations, the same is true also of the other phases of their study; but these take more patience, serious study, and often the use of the microscope and other facilities.

Common forms of life, of course, are easily divided into the two great types—plants and animals—with clear distinguishing characters for each. At the bottom of the scale of life, however, the plant and animal kingdoms converge, and there are some simple microscopic forms which are not clearly one or the other, but possess some characters of each. And so it is impossible to draw a sharp line between the plant

and animal kingdoms. But starting with slightly higher forms of life, the differences between plants and animals are well established.

Most plants contain the green coloring matter called chlorophyll. This is a complex chemical substance that enables the plant to use the energy of sunlight for its own growth and development. With it the plant manufactures the thousands of other substances necessary to life out of the carbon dioxide in the air and the water and minerals it draws from the soil. No true animals contain chlorophyll. For this reason no animals can manufacture from the raw materials of the earth and the air the essential materials of life. They must get these directly or indirectly from plants. Certain plants, like the fungi, lack chlorophyll, and therefore they too must depend on green plants for their food (*see Plant Life; Fungi*).

Other distinguishing features are these: Plant cells have walls made of the woody material called cellulose; animal cells do not. Plants are usually stationary; most animals move about freely. Most animals have well-defined nervous systems; no such system is found in plants.

The Stuff That All Life Is Made Of

But with all their differences, plants and animals have certain fundamental characteristics in common. In all forms of life, the living substance is *protoplasm* (*see Protoplasm*). And while this takes many varying forms in different plants and animals as well as in different parts of the same plant or animal, all protoplasm is fundamentally alike. It contains always the following 12 chemical elements: carbon, oxygen, nitrogen, hydrogen, sulphur, calcium, magnesium, sodium, potassium, phosphorus, chlorine, and iron. It may also contain several others, including copper. All of them are common in nature everywhere. Furthermore, all forms of protoplasm—plant or animal—are subject to

physiological reactions. They are sensitive to external influences, such as touch and temperature, and the chemical behavior of this "life substance" follows well-defined patterns (*see Biochemistry*).

All organisms feed and grow. They all breathe, in the sense that they take in oxygen and give off carbon dioxide. They

all are made up of cells and all reproduce themselves by cell division of one kind or another (*see Cell*).

Conditions of Life

In viewing the life of the world, it is always fascinating to think of the conditions that are necessary to make life possible on earth—all of them necessary. One thinks first, perhaps, of the sun and its rays, bringing light and warmth, often forgetting that the sun is also the sole source of all the energy for plant growth and for the food supply for the whole living world. And so it was, through the many million years of the infinite past, while Nature was slowly and

THE STORY OF THE TRANSMISSION OF LIFE

IN thinking of living things it is most important to realize that they are all made up of tiny units of protoplasm which we call "cells." These cells are of many kinds, each with a special task to perform. There are blood cells to carry oxygen from the lungs to all parts of the body, muscle cells for movement, gland cells to produce digestive juices, nerve cells to convey messages back and forth. But all of the cells that form a plant or an animal have come from a single cell at the beginning of its life. By a beautiful and mysterious process this single cell divides into two, and each of these into two—always two—and so on, until there have been formed the millions and millions of cells that make up its body.

Within the walls of each cell is a nucleus containing tiny threads of a substance called "chromatin." This chromatin is the most wonderful of all living matter, for it controls all life. The picture on the opposite page shows how the chromatin threads form tiny rods, which split in halves. It shows how these halves divide into two equal groups, and how each of these groups becomes the center of a new cell. The cells of an acorn multiply into a giant oak in just this way, and when you use up muscle cells in work or in play, new cells to take their place are produced in the same manner.

But more wonderful still is the process at the beginning of a new life which keeps the vital flame burning. Consider a flowering plant, for instance. Down in the flowers, sheltered from harm, are many tiny delicate egg cells—the mother cells. A gust of wind, or an insect roving in search of nectar, brings to one of these a pollen grain from another flower. This pollen grain is the father cell. Left alone by themselves the mother cell and the father cell would die. But now the chromatin in the tiny father cell, following a mysterious instinct which lies at the very heart of life's secret, grows down into the flower and unites with the chromatin of the mother egg cell, and fertilizes it. At that moment the new life of the plant begins. The fertilized cell divides again and again, as described above, until it forms the tiny embryo plant, which lies folded up within the seed and is ready to unfold and grow when the seed germinates.

The process is similar among animals,—a single tiny male cell penetrates and fertilizes an egg cell, and causes it to develop into a new animal. Half of the chromatin in that first fertilized cell is given by the mother and half by the father. That is why the new life resembles both parents. As the cells go on dividing, each of them has material from both of the parents.

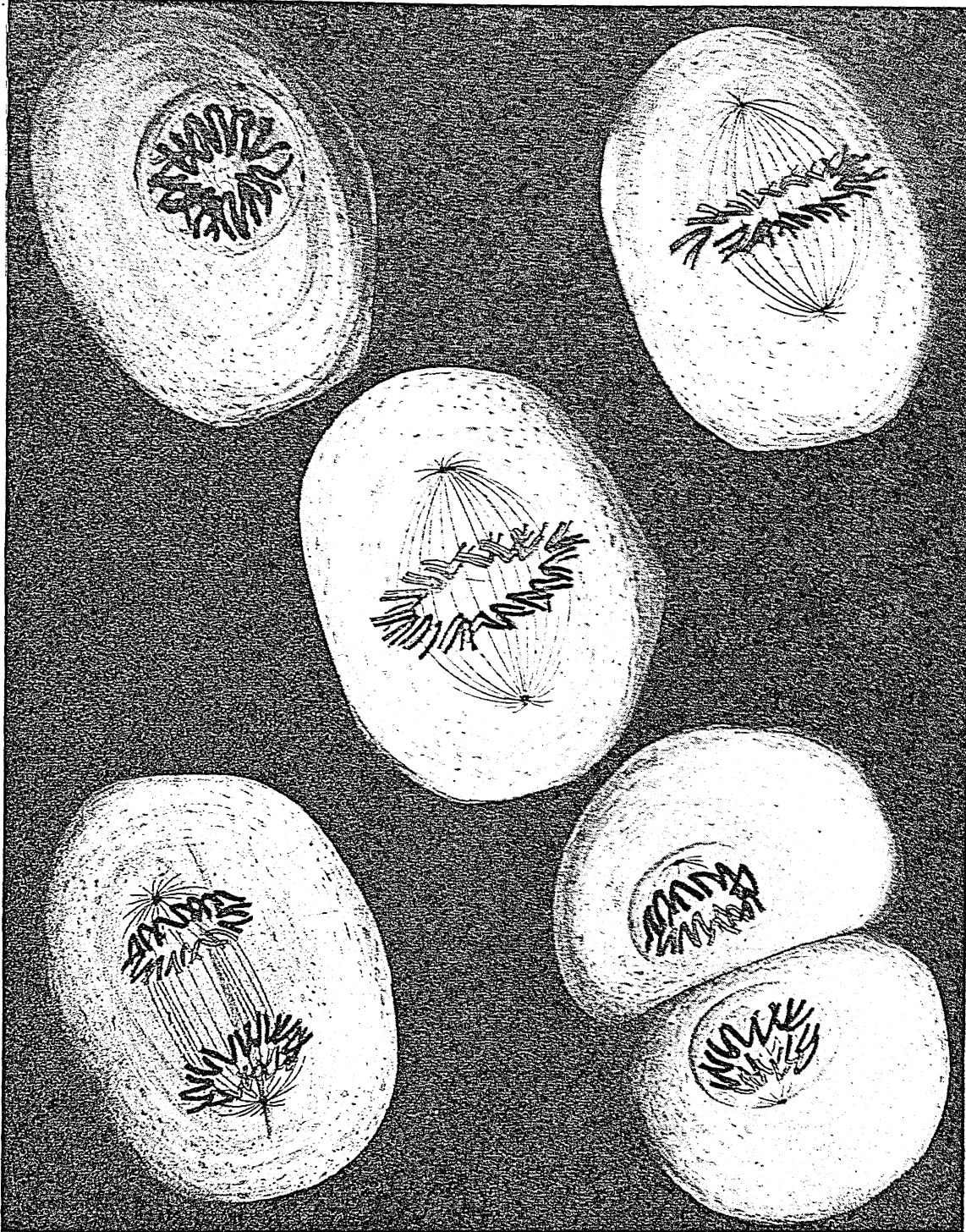
Can you think of anything more wonderful than this strange power, locked up in a cell so small that the eye can't see it—the power to multiply and create bone and muscle, nerves and brain, the power to create new life, and to carry over to that new life those complex details of face, features, complexion, and even of mind and character which the parents possessed?

patiently depositing the vast storehouses of energy in the form of coal, oil, and gas, for the uses of modern man—all derived from the remains of the plants and animals of the past! Vast quantities of water are also absolutely necessary. Water forms the larger part of protoplasm and is the universal solvent for the foods of both plants and animals. The water vapor of the atmosphere furnishes a blanket that helps to retain the heat from the sun. The vast reservoirs of the sea help to stabilize the temperature of the earth. An atmosphere of moderate temperature, with oxygen for respiration for all life and with carbonic acid for plant food, is absolutely necessary, as are also all of the chemical elements that enter into the formation of protoplasm. Other conditions, more difficult to explain, are also necessary for life as we know it.

Is there Life in Other Worlds?

All in all, life in our world is possible only by the combination of so many and such peculiar conditions

THE MOST WONDERFUL OF ALL LIFE'S PROCESSES



Here you see Nature's way of developing a new life from a fertilized egg. In the upper left-hand corner is a cell, enormously magnified. The sphere in the center is the "nucleus." Those black rods shaped like bent pins inside the nucleus are "chromosomes." They are made up of the wonderful substance called "chromatin," half of which comes from the mother and half from the father. On the edge of the nucleus are two black specks called "centrosomes." This first cell shows us the very beginning of life. Now watch that tiny life grow! In the upper right-hand corner the centrosomes have separated to opposite poles and a delicate arrangement of fibers has been formed to which the chromosomes have attached themselves. The cell in the center shows the most wonderful stage of all, for it tells us the secret of heredity. See how each of the chromosome rods has split lengthwise into exactly equal halves! In the next cell at the left, half of each rod has been pulled away from the other half by those centrosome fibers, forming now two separate groups, each made up of mother and father elements alike. In the last picture the cell walls have split, forming two new cells like the first. These will in turn split into two, and so again and again, and the new life will grow to become a plant, or a fish, or an elephant, or a man, depending upon the nature of the parent chromatin.

that it seems to us there can be no life in other parts of the universe without the same combinations—a benevolent sun, an atmosphere, vast quantities of water, etc. Given these, however, is there life in other parts of the universe? Nobody knows! But why not? It may be of course that there are not the same types we know—that there may be insects with four pairs of legs instead of three, and three pairs of wings instead of two; and humans with three pairs of limbs instead of two. You may imagine almost any forms you like; but nobody knows anything about it.

Space will permit but a few general considerations of the distribution and interrelations of living things in the world. In general the variety and wealth of *plant life* is on land, of *animal life* in the sea.

The Life of the Land and the Life of the Sea

All are familiar with the general conditions of life in the field and woods. The liberal vegetation, mostly of flowering plants, furnishes the fundamental food supply for animal life—insects, birds, mice, rabbits. Even where predacious animals feed on other animals, the latter have fed on plants. The interrelations—"the web of life"—are extremely intricate. And so it is, in greatly magnified degree, in the tropical forest. One thinks there of the luxuriant dense matted vegetation, sheltering its teeming life of insects and tropical birds and other strange life of the jungle. Here the web of life is so intricate as to baffle the imagination.

In the sea all is different. While there is often much *plant life* in the form of seaweeds (flowerless plants), especially along rocky shores, the wealth of plant life of the open sea consists of the invisible microscopic forms, especially the *diatoms*. About the *animals* of the sea there is always a peculiar fascination due to their abundance, their variety, and their strangeness. They are everywhere. Even the colder seas are populated by immense numbers of marine animals in great variety. Often along the shore—rocky, muddy, sandy—there is a baffling wealth of animal life the world over. The open sea has many peculiar forms at the surface, and still more peculiar ones at the bottom, even down as far as five miles. Fishes that are half mouth; crabs and their relatives that are mostly legs and feelers; starfish and their numerous relations; even delicate jellyfishes and polyps are there. And think of the conditions at these great depths—the tremendous pressure of five miles of water; the icy cold, even in tropical seas; the absolute darkness, except that a good many forms are phosphorescent—for not a ray of light penetrates much beyond a few hundred feet; the absolute quiet—for waves penetrate but a few feet.

All of the food and energy for this animal life at the bottom of the sea is from or near the surface, and consists of the microscopic forms of plants, or the small animals that have fed upon them. Over perhaps a hundred million square miles of the sea bottom is a deep "ooze," consisting of the skeletons of micro-

scopic animals and plants that have rained down through the ages from the surface.

Many forms of life are peculiar to the sea. Whole branches of the animal kingdom are found here alone and have never found their way into fresh water. Such are all the various forms of starfishes and their relatives; almost all of the great branch which includes the jellyfishes and polyps; almost all of the sharks; and other branches which might be named. Most of the life of the sea is fed, ultimately, by the microscopic plants that grow at the surface. Upon these tiny plants feed microscopic animals and small crustacea, even some fishes; these in turn feed the larger animals, including fishes like the cod and sharks, and whales and porpoises and other cetaceans.

Lives that Live on Other Lives

Among the most interesting and important of the biological interrelations of organisms is that of *parasitism*. There is scarcely a common form of life but has its many parasites. We think usually of the worms of many kinds that infest the intestine of man and most backboned animals; and of the insects, and other parasitic forms in or on the bodies of most visible forms of both plant and animal life. But the most deadly parasites for man and many other animals are certain species of microscopic *bacteria* belonging to the plant world, and of *protozoa*, belonging to the animals. It is they that kill most of mankind and other animals. Bacteria cause some of the rot and blight diseases of plants, and their cousins, the *fungi*, cause the rusts and smuts of grains. But not all bacteria and fungi are bad; many are of great service in getting rid of the dead bodies of larger animals and plants that would be in the way if not removed (see Bacteria; Parasites).

The Mystery of Life's Beginnings

Two or three branches of biology deserve special mention because of their significance and suggestiveness. One of the most fascinating and mystifying is the study of the reproduction and development of animals and plants—their *embryology* (see Embryology). The coming into being of an organism, especially one of the higher animals, remains one of the unsolved mysteries. Of course, it is popular knowledge that the common forms of life arise from fertilized egg-cells, but it may not be so well known that this is just as true for an earthworm or an oak tree as it is for a man or a chicken. It is true for the whole living world that "like begets like"—that all plants and animals, simple as well as complex, arise only from parents like themselves. The simplest forms of animal and plant life consist of a single cell; and they multiply merely by the single cell cutting itself in two, as described for the amoeba (see Amoeba). It seems hard to realize, however, that a human being, with its infinitude of characters, can arise from a tiny egg only a hundredth of an inch in diameter. It seems wonderful, too, that of three eggs, so nearly alike in size and appearance that it is difficult to tell them apart, one may give rise to a

starfish, one to an earthworm, and the third to a human being. In reality these three eggs are very different from one another.

The origins of the higher forms of life seem so natural to us now that it is hard to realize that people formerly believed that even complex animals, such as earthworms and frogs, arose by "spontaneous generation," that is from non-living matter, without parents. It is only in recent years, however, that science has *proved* that the origin of life is the same for the simplest forms as for the highest—for the infinitely small germs of tuberculosis or malaria, and the whole multitude of plant and animal germs that have heretofore killed a large majority of mankind, as for mankind itself. At present it can be said that man has never created even the simplest form of life, or seen it arise spontaneously. Of course, a Burbank can perform wonders in *modifying* the common forms of plant and animal life, but can never create it.

"His Mother's Eyes and His Father's Chin"

Genetics, a new branch of biology dealing with the laws of inheritance, dates back only to the beginning of the century. Since then it has been much studied, for there are "fashions" in science as well as in most human affairs. In 1900 it was realized that Gregor Mendel, an Austrian monk, working with peas nearly 40 years before, had discovered some general laws of heredity of very great importance and very wide application. The amazing thing is that Mendel's laws, found for peas, have since been found to hold good for many highly specialized plants and animals, even for some of the characters of man himself—such as the color of his hair and eyes, etc. How wide the application is, especially for man, has not yet been fully determined. While Mendel's laws do not apply to all characters of plants and animals, they are known to be of sufficiently wide application to be of very great importance in the improvement of domestic plants and animals.

It is common knowledge that plants and animals inherit the minutest characters from their parents. The amazing thing is that all the infinitude of these characters, large and small, are carried by an unbelievably small amount of matter in the fertilized egg. *Science tells us that all of the people in the world at any one time have had their heredity carried by a total of less than an ounce of matter!* Think of the wonder of the development of a human being, with all his infinitude of characters—his features, color of his hair and eyes, temperament, traits of character, and ability! Or of a great redwood tree, that is to live for several thousand years!

Stories that the Rocks Tell Us

Many plants and animals with hard parts have left remains in the rocks of the earth's crust which are called "fossils." The study of such remains is a branch of biology called *paleontology*, although this study is oftener connected with geology, the science of rocks. Paleontology more than any other science shows us the history of life in the world, through all

of the millions of years of the infinite past. One of its most interesting revelations is that there are many forms of life that developed and flourished for ages, and then entirely disappeared from the earth. These include giant lizards more than 50 feet long; grotesque monstrous mammals; giant mosses the size of trees (see *Animals, Prehistoric*). It shows us the stages in the evolution of the horse, from ancestors the size of foxes. A thousand appealing things are shown by the study of fossils. Large parts of some kinds of rocks are formed by these remains of plants and animals. The great deposits of chalk, for example, often thousands of feet thick, consist almost wholly of the skeletons of microscopic animals.

The Great Discoveries of Recent Years

Several phases of biology may best be referred to by a brief history of the science during recent times. Great improvements in the microscope, as well as other improvements, along with the growth of science in general, made possible enormous advances in the science of biology during the 19th century. By far the larger part of what is now known of this subject is *recent knowledge*, amounting to a revolution in the science.

(1) One of the first of these great advances was the realization that all plants and animals are made up of *cells*—that the cell is the unit of structure in all living things. In the simplest forms of life, both animal and plant, the whole organism is but a single cell. In all higher forms of life, man for instance, the body is composed of millions and millions of cells, of many kinds, each kind specialized for some special use—muscle cells for motion, gland cells for secretion, etc.

(2) Following shortly upon the statement of the cell theory was the recognition that the essential part of a cell is its *jelly-like substance*, which we now call *protoplasm*, and that this material is much the same in all living things, although differing infinitely in details in different types of animals and plants, and in different parts of the same complex organism. When the egg develops into the human body, for instance, the protoplasm gradually becomes different in the various types of cells.

(3) The greatest advance in biology followed Charles Darwin's statement of the doctrine of *organic evolution* and the publication of his "Origin of Species" in 1859. The rapid acceptance of the view that living things are changeable, and that the diversified forms of life—of both animals and plants—have arisen by gradual changes from simpler forms, has had a very profound influence upon all fields of biological study (see *Evolution*).

(4) *Physiology* is the study of properties, activities, and functions in living things. Formerly it was limited almost wholly to man, and was mainly a part of medical study. With the general growth of biology, physiology has been extended to the study of all living things. This has brought great benefit to medical science itself, for a large part of what is

now known of human physiology was first worked out upon frogs, cats, dogs, rabbits, etc. Fuller knowledge of plant physiology also has been of great benefit to agricultural science in recent years.

(5) Between 1865 and 1890 came many revolutionary discoveries by Pasteur and other workers, showing that *fermentations* and *putrefactions* are always caused only by minute organisms, and that these are always introduced from the outside, and never arise spontaneously (see Pasteur, Louis). It was soon realized that most of the diseases of mankind and other animals are caused by these infinitely small animal and plant parasites which we call *germs*. As applied to human living and well-being, no other discovery has ever been of such far-reaching importance. (See Germ Theory of Disease.)

Reasons for Classification

The least spectacular side of biology, but one that is of fundamental importance, is the problem of arranging the various kinds of plants and animals in some orderly fashion. Modern classification of living things is called the science of *taxonomy* (from the Greek *taxis*, arrangement, and *nomos*, law). The aim of taxonomy is not merely to catalog all forms of life by giving them distinctive names, but also to arrange them in natural groups, showing the relationships that exist between them.

According to the present system of classification, living things are separated into two *kingdoms*, the plant kingdom and the animal kingdom. Each of these is subdivided into certain grand groups, *sub-kingdoms* and *phyla*, which place together the organisms that seem to be constructed on the same general plan. Each phylum is arranged into *classes* composed of organisms, which, though similar to each other in their plan of structure, differ in some constant feature. Each class, in turn, consists of *orders*. Closely related groups within the orders are termed *families*. Each family is composed of *genera*, within which are the smallest groups or *species*.

Exactly what constitutes a species is a matter of debate; but in a general way, a species is a group of individuals essentially similar to one another in structure and capable of interbreeding. The scientific name of a species is always a binomial, that is, it consists of two words, as *Rana catesbiana*, the bullfrog, or *Quercus alba*, the white oak. The first name shows the genus to which the species belongs. Sometimes slight differences, such as coloration or size, are used to separate species into still lower groups known as *varieties*; these are designated by adding a third name.

Thus, *Papilio glaucus* (var.) *turnus* is a dark form of the great yellow- and black-striped swallowtail butterfly.

In some cases, finer divisions are made of a complicated group; orders are split up into sub-orders, families into sub-families, etc. Family names of animals usually end in *idae*, of plants in *aceae*, as *Canidae*, the dog family; *Rosaceae*, the rose family.

How this system works out in practice can be seen from the following example. The bullfrog is classified as follows:

Kingdom, *Animalia*: all animals.

Phylum, *Chordata*: vertebrates and their kin.

Sub-phylum, *Vertebrata*: vertebrates only.

Class, *Amphibia*: frogs, toads, salamanders.

Order, *Anura*: tailless amphibians.

Sub-order, *Firmisternia*: frogs only.

Family, *Ranidae*: true frogs.

Genus, *Rana*: certain true frogs.

Species, *Rana catesbiana*, the bullfrog.

Many scientists have contributed to the scheme of plant and animal classification, but the work of Linnaeus is noteworthy above all others (see Linné, Carl von). Linnaeus brought order to botany and zoölogy by arranging organisms into genera and species. He introduced the principle of binomial nomenclature which has been universally adopted. By international agreement, the scientific name of a plant or animal must be the first specific name applied to it, and this should be uniformly used throughout the world. To avoid international confusion, the names are derived from the Greek and Latin languages, or from proper nouns which are given a Latinized form.

Benefactors of Humanity

Finally, it should always be remembered that biology, like any other science or field of human knowledge, grows by the labors and discoveries of thousands of men, whom an unthinking world often forgets. Partly these discoveries are made by men who have in mind their practical use in "applied science"; partly they are made by men who work and advance science just for the sake of increasing man's knowledge of the world in which we live. Often the discoveries of the latter class in "pure science" prove to have revolutionary importance in their practical applications. Such were some of Pasteur's discoveries which helped to revolutionize medicine, though he was not a physician at all, but a chemist and biologist, and which made him perhaps the greatest benefactor of mankind in the 19th century.

— REFERENCE-OUTLINE for Organized Study of BIOLOGY —

WHAT is that magic something, possessed alike by the tiniest plant and by the largest animal, which serves to set them apart from the "dead" rock of the hillside? We are perhaps not much nearer to a final definition of life than were the old Greek sages. Yet of the facts about life we know vastly more. It is with these accumulated facts that Biology deals. It empha-

sizes certain great principles that run through the study of all forms of life, whether plant or animal. These principles are outlined here.

I. THE SCOPE OF BIOLOGICAL SCIENCE:

A. Biology, the Science of All Life: B-111.

a. Botany, the Science of Plant Life: B-203.

b. Zoölogy, the Science of Animal Life: Z-219.

B. Chief Subdivisions of Biology: In practise, each of these is usually subdivided again into botanical and zoological branches; for example, Plant Cytology and Animal Cytology.

- a. Cytology, the Structure and Functions of Cells: C-121.
- b. Histology, the Organization of Cells into Tissues: A-191.
- c. Anatomy, the Structure and Arrangement of Tissues and Organs into Complete Organisms: A-191.
- d. Morphology, the Forms of Complete Organisms: A-191.
- e. Embryology, the Development of Organisms from Single Cells: E-258.
- f. Physiology, the Function of the Component Parts of Organisms: P-202.
- g. Genetics, the Principles of Heredity: B-116, B-203; *Eugenics* is a branch or outgrowth of Genetics E-315.
- h. Ecology, Organisms in Relation to Their Environment: E-146.
- i. Taxonomy, the Classification of Organisms: B-116.

C. Relation of Biology to Other Sciences:

- a. Biochemistry: B-109.
- b. Biometry: B-118.
- c. Paleontology: F-164.

II. THE PHYSICAL BASIS OF LIFE:

A. Things Necessary to Life:

- a. Chemical Elements: B-112, B-109.
- b. Water: W-42.
- c. Heat and Light: L-125.

B. Protoplasm, the Only Living Substance: P-356.

C. Protoplasm Organized into Cells which Form Units of All Living Structure: C-121. Many primitive plants and animals consist of a single cell, as Protozoa (P-357), Bacteria (B-12). Higher forms all start life as single cells (B-112, B-113, picture).

—Cell-division:

1. Amitosis, direct cell-division (C-121, A-188).
2. Mitosis, indirect cell-division (H-255, B-113).

III. SOME BASIC LIFE PROBLEMS:

A. Nutrition, the Food Problem:

- a. Nature of Food: Proteins (P-356, B-109), Carbohydrates (B-109), Fats (B-109), Vitamins (V-309).
- b. Food Manufacture: Green plants alone by the process of *Photosynthesis* can manufacture organic foods out of inorganic materials (P-237, L-88, B-110).
- c. The Food Cycle in Nature: Animals live directly or indirectly on the food manufactured by plants (P-237); plants use the waste products of animal life.
- d. Digestion of Food:
 1. In Plants: P-238.
 2. In Animals: D-68.
- e. Distribution of Food:
 1. Circulation of sap in higher plants: P-239, T-131, picture.
 2. Circulation of blood and lymph in animals, B-157.

B. Respiration, the Oxygen Problem:

- a. How Oxygen is Obtained: R-79, P-238.
- b. How Oxygen is Utilized: P-238.

C. Excretion, the Disposal of Wastes: D-69, K-16.

D. The Problem of Sensitivity and Coördination:

- a. Tropisms: P-241.
- b. The Nervous Mechanism: K-64.
- c. Sense organs: Of sight (E-349), of hearing (E-126), of smell (S-164), of taste (T-107), of touch and temperature (T-116).

IV. THE CONTINUITY OF LIFE:

A. Asexual Reproduction:

- a. By Fission or "Splitting Apart" (C-121); as in the Amoeba (A-188).
- b. By Budding; an outgrowth on the parent forms a new individual; Hydra (H-365), Yeast (Y-204).

c. By Spore Formation; as in Bacteria (B-16).

d. By Fragmentation; as when starfishes (S-277), sponges, etc., are broken into pieces, the pieces regenerating new individuals. The "slipping" of plants is of this type.

B. Sexual Reproduction: This requires two sets of reproductive organs: male, producing sperm cells, and female, producing egg cells or ova. If these are located in the same individual, the condition is termed *hermaphroditism* or *monoecious reproduction*, as in the case of the earthworm and most flowers (F-120). If in separate individuals, it is referred to as *dioecious reproduction*, as in the case of most animals and some flowering plants.

C. Special Reproductive Devices:

- a. Parthenogenesis: the egg develops without fertilization (A-226, I-86); Honey Bee (B-74).
- b. Paedogenesis: production of offspring by immature larval forms: I-86.
- c. Metagenesis or Alternation of Generations: This occurs in organisms which have a sexual generation (the gametophyte) alternating with an asexual one (the sporophyte); Mosses (M-270), Ferns (F-24).

D. Development of New Life: E-192, S-73, E-258.

V. INTERRELATIONS OF ORGANISMS:

A. Symbiosis: The partnership between two types of plants or between plants and animals or between animals.

a. Commensalism: Organisms merely live together as "messmates" without obvious advantage or disadvantage; Pea-crab and mussel (C-388).

b. Mutualism: One or both organisms are benefited by the association; Lichens (L-122); Legumes and Bacteria (P-243); Ants and Acacia (P-239, picture).

B. Parasitism: One organism, the parasite, lives at the expense of another organism, the host (P-67).

a. Ectoparasites: Live on the surface of the host; Fleas (F-106), Mistletoe (M-212).

b. Endoparasites: Live within the body of the host; Hookworm (H-333), Flukes (W-179).

C. Saprophytism: Plants living on dead or decaying organisms as do the Mushrooms (M-306); the same condition in animals is called *Saprophitism* and is exemplified by certain soil nematodes (W-180).

VI. HISTORY OF LIFE:

A. Evolution: E-340.

a. Darwin's Theory: D-15.

b. Evidence from Geology: G-40.

—Fossils (F-162), Horse (H-340), Elephant (E-244).

c. Evidence from Comparative Anatomy: The similarity of parts (H-208, S-155); vestigial organs (E-341).

d. Evidence from Embryology: The Recapitulation Theory, which states that the developing embryo passes through all the stages of its ancestral history (E-341).

B. Heredity and What It Means: H-233.

RELATED SUBJECTS: For more detailed study of the subdivisions of Biology and other related subjects, consult the following Reference-Outlines:

BOTANY: B-205

PSYCHOLOGY: P-353

ZOOLOGY: Z-227

AGRICULTURE: A-60

NATURE STUDY: N-40

GEOGRAPHY: G-35

PHYSIOLOGY: P-207

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BIOMETRY. The application of mathematical methods to biological problems is known as biometry (life measurement). Like other applications of statistical methods, it deals with a large series of observations, arranges them in order, and attempts to formulate general statements that will be true for the entire group. The application of statistical methods to the study of man is called anthropometry.

L. A. J. Quetelet (1796-1874), a Belgian astronomer, applied mathematical laws to the study of human stature, and pointed out the way to use mathematics in solving biological problems. This work aroused Sir Francis Galton (1822-1911), the actual founder of biometry, who was interested in the inheritance of ability and wished to bring order out of a vast collection of records. In turn, Galton influenced Karl Pearson, and the work of these men was further supplemented by the studies of W. F. R. Weldon, Raymond Pearl, J. Arthur Harris, and other biometricians of today.

The things with which biology deals are extremely variable. Apples from the same tree, for example, vary in size, weight, and color. A fruit grower could determine the average weight of the individual apples and thus compare the trees with respect to their product. But the fruit grower is not interested in an "average" apple; he desires to get a constant product. A measure of the variability of the fruit would provide him with more useful knowledge. Variability is measured by the *standard deviation*, which shows the amount of "scatter" about some selected value. The most commonly used value is the average, or arithmetic mean (see *Graphs and Statistics*).

Applying Mathematics to Biology

The solution of many problems in biology is aided by working out mathematically the *correlation coefficient*. This is a number which indicates the degree of relation between two variable factors. It may show that there is no relation whatever between various facts, or that the relation is perfect and positive, or that the relation is perfect and inverse. Is there any connection between eye color and hair color, or between tree ring growth and sun spots, or between the weight of a hen and its egg-laying capacity? The

correlation coefficient is a mathematical tool designed to solve countless problems such as these. (See *Individual Differences*.)

Biometry also enables the scientist to determine the trustworthiness of a series of observations. The variability of the sample and the number of cases studied affect the accuracy of any general statement that might be made. The *probable error* tells how accurate a series of observations is as a basis of generalization, and how much allowance should be made for unavoidable errors.

Studying the Laws of Chance

The laws of chance also play a part in biometry. If you take six pennies, toss them 200 times, and keep count of the number of "heads" you will find that the number of heads obtained will practically equal the number of "tails." "Chance" events are not chaotic, they obey certain mathematical laws. The fact that three or four cases of a disease occur in the same house may lead someone to infer that the illness is "catching." But if the distribution of the disease is studied over an entire district, it may appear that the occurrence of several cases in the same house is wholly due to chance, and does not mean that the illness is infectious.

Biometry is of great value in studies of human heredity where actual experiments are impossible. Francis Galton collected measurements of the height of parents and height of their offspring in over a thousand cases. Analyzing these data, he was able to show that the children of parents that are either below or above the average are nearer the average than were their parents. In other words, the offspring tend to be like the average, and not like the extremes of the parent generation. Other biometricians continued the investigation and showed that the inheritance of eye color, mental ability, length of life, and other characteristics followed the same important "law of regression."

In medical science biometry is also much used. J. Arthur Harris studied the measurements of "basal metabolism" made of hundreds of men and women. Basal metabolism is the ability of the human body, when at rest, to utilize food properly in the tissues.

For practical purposes, it may be defined as the measure of the heat produced by a person when he is lying quietly awake, before breakfast. This is a useful index of man's vitality and is valuable in diagnosis. Harris found that basal metabolism was independently affected by weight, height, age, and sex. This made it possible to predict what should be the probable basal metabolism of any individual, if weight, height, age, and sex are known. And so, when basal metabolism is measured, and found to be much higher or lower than the predicted value, the physician knows that this is a sign of trouble and can prescribe accordingly.

Raymond Pearl applied biometrical principles to a study of the growth of populations. He found that human populations grow according to the same law as do populations of experimental groups of lower organisms. Starting with a few fruit flies in a half-pint milk bottle, he kept count of their rate of increase—their slow start, their rapid rise in numbers, and the final condition of saturation when no further increase was possible on account of the limited space. The mathematical curve which expressed this story of the growth of fruit flies in numbers was then applied to the population history of various countries. It fitted the facts of human populations. Pearl was able to predict, for example, that the population of the United States for the year 1930 would be about 122 millions, and for the year 1940 it would be about 136 millions. He also predicted that by the year 2120 the population would become stationary at about 197 millions, and no further increase could be expected.

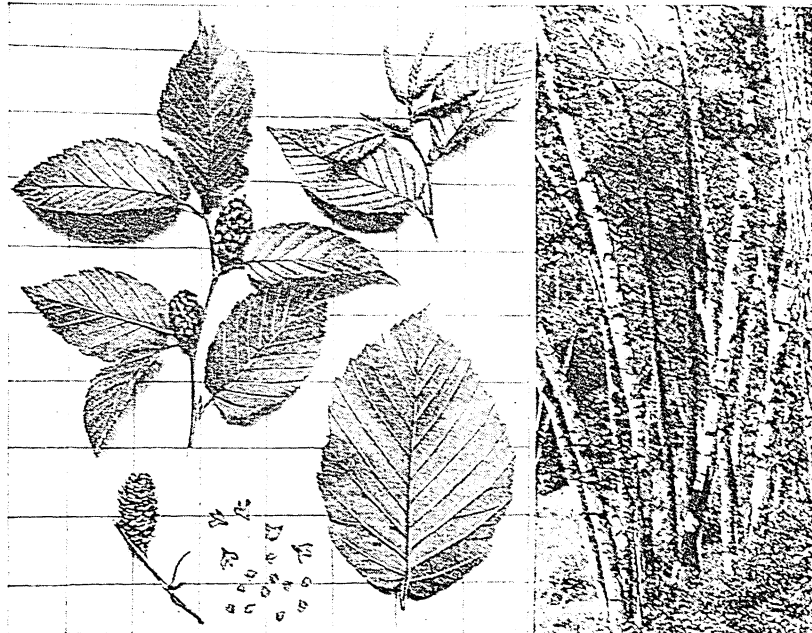
The mortality or "life expectancy" tables and other vital statistics upon which life insurance companies base their premium rates (see Insurance) are computed according to the methods of biometry.

BIRCH. The slim, graceful birch with its creamy bark and dainty, yellow-green leaves gives an appearance of delicacy which it little deserves. It is, in fact, extremely hardy. No tree grows farther north than the birch, and it is often the first to spring up in burned and cut-over areas.

The bark is so heavily charged with resin that it is practically waterproof. Long after the wood of fallen trunks has rotted away, the encircling bark remains sound. This quality made it valuable to the American Indians as covering for their canoes. The paper, or canoe, birch was preferred because the bark

peels off in great slabs (see Canoes and Canoeing). The wood is very hard and close-grained. The beautiful reddish-brown heartwood of the yellow and the sweet birch is used in the manufacture of furniture,

THE SLENDER GRACE OF THE BIRCH



The leaves of the birch are oval with saw-toothed edges. In winter and spring tassel-like catkins, the pollen-producing flowers, appear at the tips of the twigs. Near each cluster is an upright flower which receives the pollen and develops into a cone bearing winged seeds. Some of the birches, such as those at the right, are among the loveliest of trees, with their gleaming bark and their slender, gracefully drooping shape.

interior finish, and veneers. From the white wood of the paper birch are made spools, barrel staves, cross-ties, and paper pulp. Sweet and yellow birch yield an oil similar to wintergreen oil. Birch is also used in the production of wood alcohol.

The birches (genus *Betula*) number about 40 species of trees and shrubs, scattered throughout the northern hemisphere. The paper, or canoe, birch (*Betula papyrifera*) is the most widely distributed. It ranges from the lower Arctic regions to the northern United States from New England to the Lake states. A subspecies, the western paper birch, is found from northern Montana to eastern Washington. The paper birch is a medium-sized tree, 50 to 80 feet high, that seldom lives more than 150 years. The yellow birch (*B. lutea*) is the most important commercial species. Its range is southern Canada, northeastern and northern United States as far west as the Lake states, and south in the Appalachian Mountains to Georgia. Under favorable conditions it reaches a height of 100 feet and may live 300 years.

Sweet, black, or cherry birch (*B. lenta*) reaches its best development in the Appalachian Mountains. The bark, which suggests cherry in color and appearance, does not peel as does the bark of most other birches. River, water, or red birch (*B. nigra*) is the southernmost species, found on the banks of streams from New England to Minnesota and south from eastern Texas to northern Florida. White or gray birch (*B. populifolia*), a small tree 20 to 30 feet high, is found chiefly in southeastern Canada and northeastern United States. It is especially plentiful on abandoned farms and burned-over land. The western red birch (*B. fontinalis*) is a small shrubby tree which grows in the Rockies and the Sierra Nevada, and east to the Black Hills.

Our CHARMING NEIGHBORS in FEATHERS



Feeding three hungry babies keeps this Chickadee busy.

The Fascinating Story of the Lives, the Loves, and the Homes of One of Nature's Most Interesting Families, and Why it is Man's Most Useful Ally

BIRDS. Of all animals birds are the most easily defined, because they are the only ones which bear feathers. The feathers are outgrowths from the skin, like the scales of reptiles or the hairs of mammals, but they are much more beautiful adaptations to the life which the birds lead (see Feather).

Birds, with the fishes, reptiles, amphibians, and mammals, make up the division of the animal kingdom known as *vertebrates* or *backboned animals*. Because of the modifications necessary for flight, however, the backbone of a bird, like the rest of its skeleton, seems very different from those of the other vertebrates. If you examine the skeleton of a bird and compare it with that of a reptile or a mammal, you are impressed by the way in which nature makes over structures to suit different needs. Birds are believed to have evolved, during geologic times, from a reptile-like ancestor; and the differences in their structure which seem so great today have been brought about by the birds learning to fly. Birds today do not have teeth, but many fossil birds had teeth, just as their reptile cousins still have.

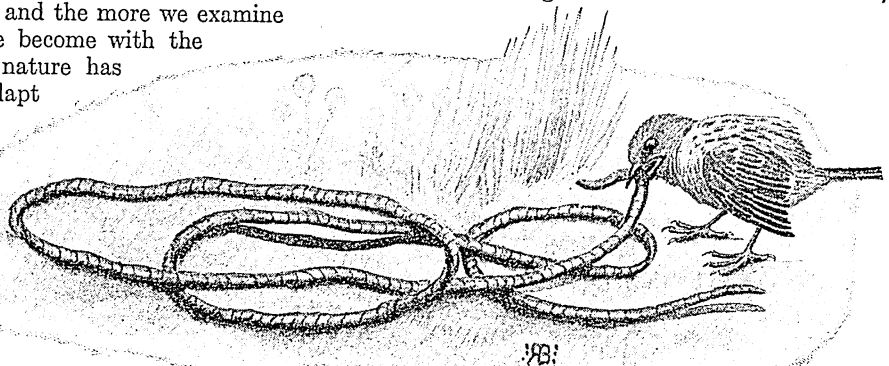
How Nature Built the Bird for Flying

The framework of an airplane or any flying machine must be very strong and compact and at the same time very light. A bird is a flying machine, and its skeleton is its framework; and the more we examine it the more impressed we become with the wonderful way in which nature has transformed each part to adapt it to the bird's needs.

The backbone for example has been shortened, and the separate vertebrae of the trunk have been fused with each other and with the pelvis to give it greater strength. The ribs are firmly attached to this and also to the breastbone, and

they have overlapping appendages to give the trunk great solidity. All of the bones are hollow, to give them the greatest strength for their weight.

In an airplane the engine and the passengers and all the heavy parts are placed as near the center of gravity as possible, and with a bird it is the same. The outlying parts, such as the head and tail, wings and legs, are made extremely light, and the heavy muscles that work them are attached to the trunk, only the tendons extending to the outermost parts. When one examines the skull he is immediately impressed with the thinness of the bones. There are no teeth, and the jaws, therefore, need not be heavy; for the work of mastication, which would require muscles and weighty bones, is performed by the gizzard, a modified portion of the stomach, located near the center of gravity. When we examine the tail, we see that the numerous vertebrae which make up the tail of a reptile are all shortened and fused into one little bone called the *pygostyle*. One is quick to notice that the largest muscles of the legs are located about the thigh bones, which are held close against the trunk and thus near the center of gravity. As if to make up for the shortening of the leg which this position causes, the ankle and foot bones are fused and drawn out into a long slender bone called the *tarsus*,



Give him time! Give him time! You can't expect that young Robin to swallow 14 feet of earthworm all at once! But a little robin can and does eat 14 feet of earthworms every day—taking a worm or a piece of one at a time, you understand, as mother supplies it

which is the only part of the leg that usually shows below the feathers, and to which the toes are attached. When we examine a bird's wing, which is nothing more



One of the very earliest of the early birds, the Archaeopteryx, now found only as a fossil. The reptile relationship can clearly be seen in the teeth in both jaws and the three claw-bearing fingers on each wing.

one finger remaining well developed, though traces of two others have been retained. Thus we might go on examining every part of the bird's anatomy, and we should discover in each case that while the original reptilian parts are still recognizable, they have been transformed through the course of ages to make the bird a perfect flying machine.

Why the Reptile's Blood Turned Warm

Another great difference between birds and reptiles is that birds, in common with the mammals, are warm-blooded animals. The chief difference between warm-blooded and cold-blooded animals is that the warm-blooded have a constant temperature, while the temperature of the cold-blooded animals varies with that of their environment. It is for this reason that reptiles become very sluggish in cold weather, a characteristic that would not fit in well with the needs of a flying bird. We may assume, therefore, that one of the most important changes that took place in the development from the reptile was the change from a cold-blooded to a warm-blooded condition. This change brought with it many accompanying changes in the life of the bird, for it ordained that the bird's eggs, also, should be maintained at a constant temperature, and that the temperature of the young should not fall below normal. This resulted in the need for "incubation" of the eggs, the building of nests, and the care of the young, which form such a conspicuous part of the bird's life today. This is likewise

than the bird's arm or front leg modified for the particular purpose of flight, we see how few heavy muscles are borne upon it. The strong muscles that manipulate the wings are attached to the keel of the breastbone, forming the familiar meat of the fowl's breast, and are thus brought close to the center of gravity. The unnecessary bones of the wrist and hand are fused, only



The Hoatzin of the Amazon Valley is the nearest living approach to the Archaeopteryx. The young have claws on their wings with which they climb about the trees.

one of the fundamental reasons for the comings and goings or the "migration" of birds, which makes their study so fascinating; for if they were still cold-blooded animals they would undoubtedly "hibernate" during cold weather. It is also the reason for their insatiable appetites. It is because Mother Nature developed in them a bodily temperature much higher than that of man that their life processes go on at a much more rapid rate, causing their ceaseless search for food.

The eyes of birds are very highly developed, so that they can see great distances and follow rapidly moving objects. Thus a swallow or a night-hawk dashing through the air at breathless speed is able to keep its eyes on a tiny insect which is also moving rapidly. The eagle or vulture, soaring almost out of sight in the air, will dart with the speed of a bullet to a tiny object a human eye would hardly notice at a distance of a hundred feet. Likewise birds can adjust their eyes for different distances much more quickly than can other animals.

What We Owe to Our Feathered Friends

This ceaseless search for food gives birds their great economic value, for it enables mankind to compete with the hordes of insects for mastery of the earth's surface. "Without the birds, not only would successful agriculture be impossible, but the destruction of the greater part of the vegetation would follow." We can appreciate the meaning of this statement by H. W. Henshaw, former chief of the United States Biological Survey, if we stop to consider the great reproductive capacity of most insects, particularly those that feed upon vegetation and are therefore dangerous to crops.

The common potato bug, if left undisturbed, is capable of producing 60 million offspring in a single season. A common plant louse, which brings forth living young, has such a short life cycle that there may be 13 generations in a single season; and inasmuch as each female brings forth at least 50 young, the number

in the 13th generation alone would be 10 sextillion. If left undisturbed and given plenty of food, it would take any insect only a few years to completely cover the earth with its offspring. The need of birds and other enemies of insects is, therefore, very apparent.

The astonishing



When the Hoatzin (also called the Ama) grows up, the wing claws are shed and the bird looks much like a pheasant. This remarkable bird is a native of the Amazon Valley.

number of insects consumed by birds has been discovered by examining the contents of crops and stomachs. Scientists also make interesting observations by watching individual birds through high-powered field glasses and counting the insects they eat, or by observing the food brought to the young in their nests. Birds require a much greater amount of food than do other vertebrates. Their temperature and rate of respiration are higher, and they are far more active.

Experiments have shown that young birds consume from one-half to their full weight of food, or even more, every day. One of the most remarkable cases of feeding on record is that of a house-wren which fed its young 1,217 times in 15 hours and 45 minutes. A pair of chickadees were observed to feed their young 40 times in 30 minutes; a pair of purple martins 312 times in a day; and a pair of rose-breasted grosbeaks 426 times in 11 hours. The crop of a grown flicker has contained as many as 1,000 chinch bugs at a time. A nighthawk's crop was found to contain 500 mosquitoes. Birds congregate in great numbers whenever there is a plague of insects. The gulls that saved the pioneer Mormons from ruin by a cricket plague were honored by a monument in Salt Lake City.

The information gained from scientific study of birds' food is put to very practical use. Mallard ducks are often introduced into swamps and ponds to rid them of mosquito larvae. Utah farmers have introduced California quail to fight the alfalfa weevil. And market gardeners occasionally put wild birds in their greenhouses to destroy the caterpillars and insects that infest their vegetables.

Birds also play an important part in the destruction of weed seeds and in the dispersal of seeds to new or barren areas. Here again, the number which they consume is remarkable. One bob-white stomach contained 10,000 pigweed seeds. That of a mourning dove contained 7,500 seeds of sorrel and 9,200 seeds of pigeon grass. Moreover, the number of insects or seeds found in a bird's stomach represents only one meal of many taken during the day. The United States Department

of Agriculture at one time set aside a tract of land in Maryland for the purpose of determining the value of birds on a farm. More than 600 bird stomachs were examined during the experiment. It was estimated that the birds destroyed 46,000 seeds per acre in 24 hours. The number of weeds thus eliminated from one farm in a year is enormous.

Carrying Seeds to Barren Lands

Not all seeds consumed by birds are destroyed, however. Many pass through the digestive tract unimpaired, to germinate again. Or the birds may disgorge them after they have eaten the fruit containing them. In this way many millions of seeds are being scattered broadcast. Hedgerows often spring up between fields along the line of fences or electric wires, where perching birds have deposited seeds. Many an old field, abandoned because of its barrenness, springs to new life with trees, flowers, and weeds that have grown from seeds scattered by the birds, although rodents and the winds also play a part in this work. Barren ocean islands are "planted" by birds from the mainland. Birds also carry seeds in mud adhering to their feet. Charles Darwin, the naturalist, reared 82 plants from one ball of earth on the foot of a partridge.

The destruction of rodents is a third service which birds perform for the farmer. Rodents feed chiefly on roots and green crops. The damage they do amounts to millions of dollars every year. They multiply very rapidly. The common meadow mouse is so prolific that the offspring of a single pair would in five years, if they all lived, number several million. Hawks, owls, and other predatory birds are nature's check upon the numbers of rodents. Each hawk or owl requires the equivalent of three mice a day, or more than 1,000 a year. Owls are far more effective than cats in clearing out a rat-infested barn. Rodent plagues, like insect plagues, are always accompanied by swarms of birds. On the other hand, a region that is stripped of its predatory birds by ruthless hunting or other means, invariably becomes infested with rodents.

A fourth way in which birds serve man is as game.

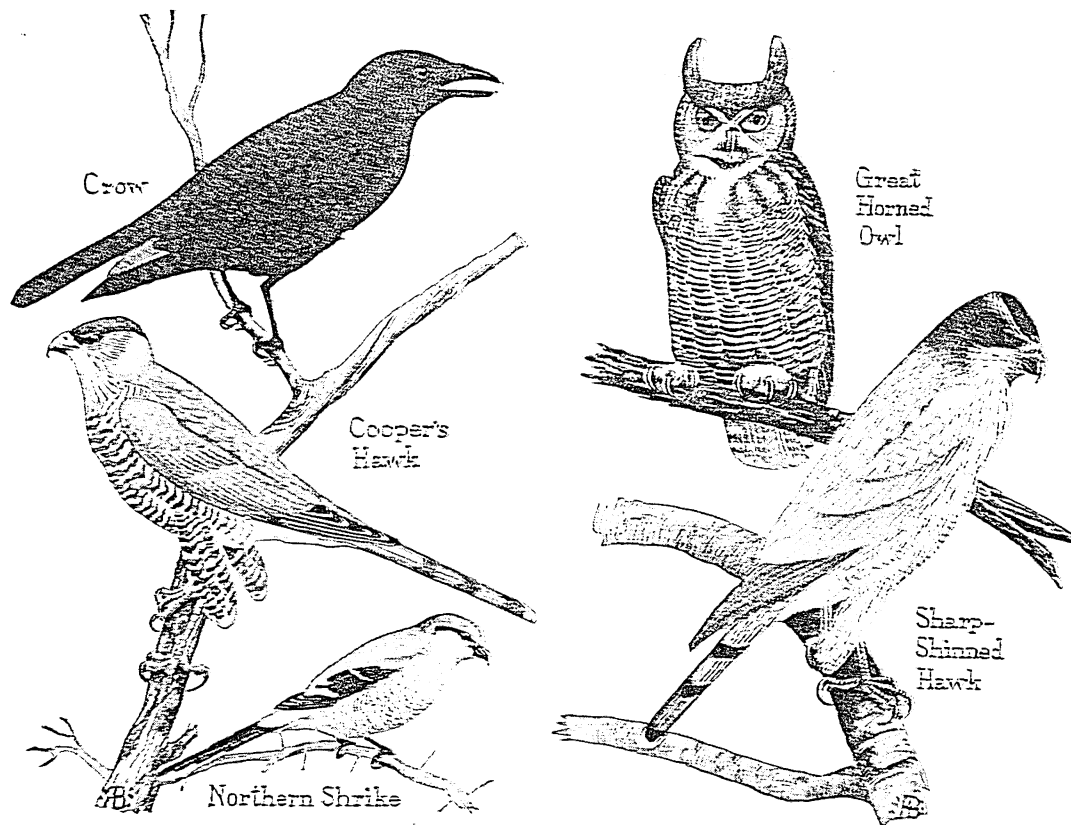
TABLE OF STATE BIRDS

| | | | | | |
|------------------|--------------------|---------------------------|--------------------|---------------------|---------------------|
| Alabama..... | Flicker | Maine..... | Chickadee | Ohio..... | Cardinal |
| Arizona..... | Cactus Wren | Maryland..... | Baltimore Oriole | Oklahoma..... | Bob-White |
| Arkansas..... | Mockingbird | Massachusetts..... | Chickadee | Oregon..... | Western Meadowlark |
| California..... | Valley Quail | Michigan..... | Robin | Pennsylvania..... | Ruffed Grouse |
| Colorado..... | Lark Bunting | Minnesota..... | Goldfinch | Rhode Island..... | Bob-White |
| Connecticut..... | None | Mississippi..... | Mockingbird | South Carolina..... | Carolina Wren |
| Delaware..... | Blue Hen Chicken | Missouri..... | Bluebird | South Dakota..... | Western Meadowlark |
| Florida..... | Mockingbird | Montana..... | Western Meadowlark | Tennessee..... | Mockingbird |
| Georgia..... | Brown Thrasher | Nebraska..... | Western Meadowlark | Texas..... | Western Mockingbird |
| Idaho..... | Mountain Bluebird | Nevada..... | Mountain Bluebird | Utah..... | California Gull |
| Illinois..... | Cardinal | New Hampshire..... | Purple Finch | Vermont..... | Hermit Thrush |
| Indiana..... | Cardinal | New Jersey..... | Goldfinch | Virginia..... | Robin |
| Iowa..... | Goldfinch | New Mexico..... | Roadrunner | Washington..... | Willow Goldfinch |
| Kansas..... | Western Meadowlark | New York..... | Bluebird | West Virginia..... | Tufted Titmouse |
| Kentucky..... | Cardinal | North Carolina..... | Carolina Chickadee | Wisconsin..... | Robin |
| Louisiana..... | Brown Pelican | North Dakota..... | Western Meadowlark | Wyoming..... | Western Meadowlark |
| | | District of Columbia..... | Wood Thrush | | |

Certain birds, such as the grouse, pheasants, snipe, woodcock, ducks, and geese, seem to serve man best by providing him with invigorating sport and food for the table. None of them are particularly important as a destroyer of insects, and many of them become even harmful to agriculture if they occur in large numbers. Such birds are naturally prolific, and when properly protected by game laws are able to withstand, in suitable localities, the losses which they

small fruits, so that early strawberries, raspberries, and cherries often suffer from their depredations. Where there is a plentiful supply of the native fruits, however, or where many mulberry trees have been planted, the cultivated fruits are left alone. Other birds, that customarily feed upon weed seed, often prove destructive in grain and rice fields, so that it is necessary to frighten them away. Blank cartridges are as effective as the loaded ones, and they have the

FIVE HIGHWAYMEN OF THE AIR



It all depends on your point of view whether you consider these feathered bandits as your friends or your foes. The Crow, for instance, at times eats the eggs of other birds and kills their young in the nests; but he also destroys an enormous number of harmful insects, and expert agriculturists look upon him as a benefit to the farmer. The Great Horned Owl will occasionally dine on a young chicken, but his usual fare consists of field mice which are enemies of crops. Not so much can be said for Cooper's Hawk and its smaller relative the Sharp-shinned Hawk, for these live chiefly on birds and poultry. The Shrike, on the other hand, destroys great numbers of grasshoppers, mice, young snakes, frogs, etc., as well as an occasional sparrow. His habit of pinning the bodies of his victims on thorns has won him the name of "Butcher-Bird."

receive. Certain species, like the ring-necked pheasant and mallard duck, are being bred in captivity in large numbers and released where the natural supply of game has been greatly depleted. The subject of game breeding is receiving more and more attention in this country, and is being encouraged by legislation so that in a few years it will undoubtedly offer an inviting occupation to young people interested in birds.

Although practically all birds are valuable to man in some one of the four ways mentioned, there are a few that usually prove troublesome at certain seasons of the year. Most birds for example, are fond of

advantage of preserving the birds to feed upon the insect pests the following spring and summer. Crows, hawks, and the great horned owl are enemies of the poultryman and the game breeder, but otherwise they serve an important function.

The Delights of Bird Study

It is not merely because of their economic value, however, that birds are so extensively studied all over the world. Their cheerful songs, their bright colors, their many pleasing ways, serve to draw thousands of people from lives of confinement or inactivity into the woods and fields, in the pursuit of recreation that is as health-giving as it is fascinating. Those who are

unable to go far afield can, by suitably planting their grounds or offering food and water, attract dozens of these little feathered sprites close to their windows, where they can with little effort watch their many amusing and interesting ways and hear their cheerful songs. Though we may fix the dollar value upon the insects devoured by the little song sparrow, we can never estimate the wealth which his cheerful song brings to those that have an appreciation of birds. And it is the small birds who are the singers generally, while the large ones are of little or no importance as songsters.

The Geography of the Bird World

As soon as one begins to observe birds he discovers that the different kinds are found in different sorts of places. Some, like the robin and bluebird, are widely distributed in woodlands, orchards, and gardens throughout the country from Alaska to the Gulf, while others are restricted to certain localities or to particular environments. Thus the Ipswich sparrow nests only on Sable Island, Nova Scotia; and the Kirtland's warbler is found, during the summer, only in the jack-pine woodlands of central and northern Michigan. If one wishes to see rails, gallinules, and coots he goes to the marshes; and if he wishes to see bobolinks, meadow-larks, and vesper sparrows he goes to the upland fields. The study of *local distribution* offers many interesting problems to the amateur as well as to the scientific ornithologist.

The study of the distribution of birds over the surface of the earth, or their *geographic distribution*, offers many other difficult and fascinating problems. If the world should be charted according to its families of birds rather than according to its races of people or its governments, it would make a strange map, because all the birds of the Northern Hemisphere are more closely related to each other than are the birds of many adjacent islands of the East Indies. Six main divisions or geographic regions have been recognized by ornithologists, as follows: New Zealand, Australian, Neotropical (South America) Indian, African, and Palearctic (North America, Europe, and northern Asia). While a few birds are found all over the world, and others in two or more of these regions, the vast majority of species and many whole families are restricted to some one of these geographic regions. In traveling around the world, therefore, one would expect to find greater difference between the birds of North and South America or between those of Europe and Africa than between those of Europe and North America. When we study the birds of the East Indian Islands, we discover some of the strangest facts of distribution, for a part of the islands lies in the Australian region and a part in the

Indian, and the line between the two is very sharp. Thus the islands of Bali and Lombok (in the Malay Archipelago just east of Java), though but 20 miles apart, differ as greatly in their animal life as do Africa and South America. This indicates that the two islands were separated at an enormously remote epoch, the deep strait between them being the dividing line between Asia and what was once the Australian continent. (See East Indies.)

In consideration of the geographic distribution of birds, the home of each species is considered to be that place where it builds its nest and raises its young, but many species migrate with the change of seasons from one region to another. Thus many of the North American birds spend the winter in South America, but do not nest there.

The Wonders of Bird Migration

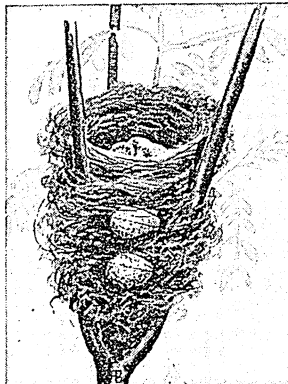
In all the fields of Nature study you will find nothing more wonderful than this seasonal migration of birds. The little bobolink that visits the northern United States in summer, travels 5,000 miles over land and sea to his winter home on the pampas of southern Brazil. The golden plover wings a 2,000-mile flight over the Atlantic from Labrador and Nova Scotia to South America without a stop; while his relatives on the Pacific coast each year travel the 2,000 miles from Alaska to the Hawaiian Islands and back again. Not all birds, of course, migrate; for woodpeckers, nut-hatches, chickadees, grouse, and a host of others are permanent residents of Canada and the United States. But robins and bluebirds, herons and ducks, warblers, fly-catchers, thrushes, and hundreds of other species join the yearly migration from south to north and back. (See Migration of Animals.)

The Mating of the Birds

During the winter the birds travel about in scattered groups, searching for food; and of course they do not nest, although a few of them sing fragments of their songs. The sexes are often in distinct flocks, and the reproductive organs are very small and nonfunctional. With the approach of spring the reproductive organs begin to enlarge and the birds begin to feel the instinct to move northward. The males are usually the first to start north, and arrive on the nesting grounds from a few days to a few weeks before the females. Once arrived, the males usually select the general locations where they wish to nest, and drive all rival males from these areas; at the same time they try to entice the females to remain and to mate with them.

Often a male returns to the same spot year after year, and frequently his former mate returns also and they remate for another year. This may occur until the death of one bird, when the surviving member

THE LAZY COWBIRD



A Cowbird, too lazy to hatch her own young, has laid two eggs in a Yellow Warbler's nest. Each time the Warbler covered over the unwelcome egg, and at last got a chance to lay her own eggs.

ordinarily finds a new mate and often returns to the same nesting site. Thus a pair of orioles have been known to nest in the same tree for 33 years, but undoubtedly they were not the same two birds. Although monogamy or a single mating for the year is the rule, a few birds, akin to our common poultry, such as the turkey, grouse, and pheasant, are regularly polygamous—that is, each male is mated to several females. Polygamy occasionally occurs among other birds, especially the wrens and blackbirds. Cowbirds do not have permanent mates, even for a single season, as they do not take care of their own young, but lay their eggs in other birds' nests. A bird of tropical America called the *ani* is regularly communistic—that is, the members of this species build a common nest in which several females lay their eggs, and all help to care for the young.

How the Birds Go Courting

Mating is never accomplished without a more or less elaborate courtship. It is during this period that birds are seen and heard to the best advantage, for the male birds try to make themselves as conspicuous as possible, both by their songs and by the display of their plumage. Of course all birds do not sing, and a few—such as the storks, the pelicans, and the frigate birds—seem to be voiceless in adult life. True song is confined to the higher families of birds, and reaches its best development among the thrushes.

The vocal organs of a bird are somewhat different from those of man, for instead of having vocal chords located in the *larynx* at the upper end of the *trachea* or windpipe, they have simple membranes, which vibrate, located at the lower end of the trachea in a structure called the *syrix*. The shape of this structure, and the number of muscles which control the tension of the membranes, vary with the different families of birds and produce the different songs.

Birds which are unable to sing usually have substitutes for song to announce their presence to the females. Thus the woodpeckers produce a loud tattoo by hammering with their bills upon a hollow limb or other resounding surface. The ruffed grouse produces a loud drumming sound by beating the air with its wings; and the woodcock produces a winnowing sound by mounting high in the air and zigzagging back to earth on set wings so that the wind whistles through the three outer wing feathers.

Even more interesting than the sounds produced by birds are the many curious displays of plumage and courtship antics. The display of the peacock, the turkey, and the domestic rooster are familiar to all; and many of the smaller birds can often be seen going through similar performances. Other birds, such as the pouter pigeons, the prairie chickens, and the European bustards, have peculiar air-sacs which they inflate during their courtship, giving them a very grotesque appearance. The European skylarks and our horned larks perform feats of flying during their courtships that are quite spectacular. After mounting to such a height that they are barely visible, and after hovering and singing at that dizzy height, they suddenly close their wings and drop like stones toward

the earth. One thinks they are about to dash themselves to pieces, when they gracefully spread their wings and alight, only to repeat the performance. Many of the albatrosses and cranes, and certain small birds as well, have elaborate series of hops, skips, and bows which might be likened to old-fashioned dances. Among the most elaborate courtship performances are those of the bower birds of Australia, which build little bowers of twigs or plant stems. These bowers are entirely distinct from their nests, and are usually decorated with bright berries, shells, or flowers, which are renewed as often as withered.

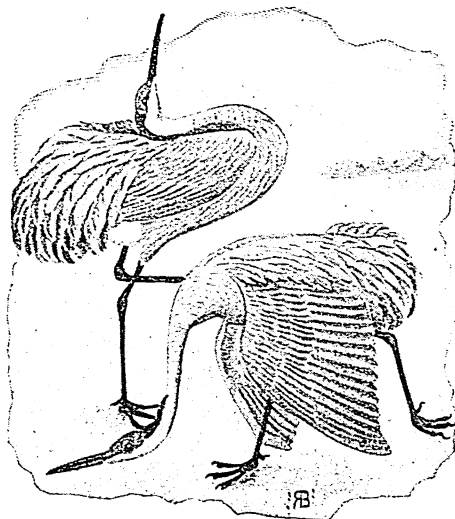
"Now for That House of Ours"

After mating, birds usually set about nest-building immediately. Although the male has already selected the nesting area, the female usually selects the exact nesting site and builds the nest, the male standing

guard near by or accompanying her in her search for nesting material, and permitting no other male to approach within his precincts. The character of the nest depends upon the species of bird and the family to which it belongs. It has undoubtedly had its origin in the requirements of the young—how long they must use it and the dangers to which they are exposed—together with the intelligence of the bird in meeting these requirements.

When birds evolved from their reptilian ancestors, they undoubtedly at first laid their eggs as do the turtles and lizards today, burying them in the sand or hiding them in holes in trees. But as they became warm-blooded creatures and the need for incubation arose to keep the eggs at a constant temperature, it

STATELY COURTING OF THE CRANES

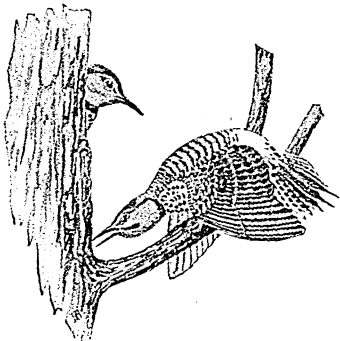


Nothing can exceed in stately ceremony the dances of these Sandhill Cranes. A traveler thus describes one of these very formal social events. "The male suddenly wheeled his back towards the female and made a low bow, his head nearly touching the ground and ending by a quick leap into the air. Another pirouette brought him facing his charmer, whom he greeted with a still deeper bow, his wings meanwhile hanging loosely at his side. She replied by an answering bow and hop, and then each tried to outdo the other in a series of spasmodic hops and starts mixed with grave and ceremonious bows."

was necessary to lay them above ground, so that they could be brought into contact with the bird's body. At first the birds probably did not even scratch depressions to keep the eggs from rolling about, but laid them on the flat ground as do the night-hawks and whippoorwills today. The next stage was doubtless the scratching of depressions to keep the eggs from rolling, and we find this stage represented today by the nests of the killdeer and other plovers. An advance from this stage was the addition of a lining to the depression, such as is seen in the nests of the sandpipers. Such nests, however, give little protection against long spells of wet weather or against the numerous terrestrial enemies. It is easy to imagine that the birds that learned to raise their nests above ground, first on piles of vegetation and then into bushes and trees, were more successful in raising their young, especially if the young had to remain in the nest for some time.

It is not difficult to select from the nests built by birds today a series which shows the probable evolution of nest architecture, from the crudest to the most elaborate. Thus, the simplest platforms of sticks are built in the trees by the herons, while the crows and hawks build more substantial structures of sticks with deeper hollows to hold the eggs and usually with linings of softer materials. Continuing up the scale we find the coarse twigs discarded for finer and softer materials, until we come to such nests as those of the yellow warbler or goldfinch, which are made almost entirely of plant downs or other woolly substances. The

MR. FLICKER SHOWING OFF

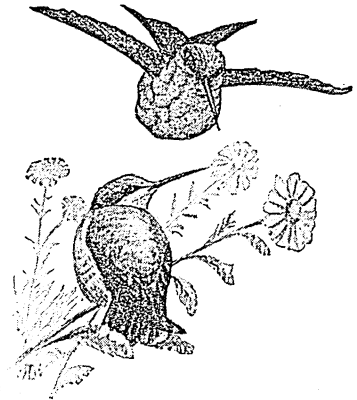


Mr. and Mrs. Flicker have dug out their little cottage in a tree and Mrs. Flicker, sitting in the front door, is watching Mr. Flicker "show off" for her special benefit.

that they resemble knots instead of birds' nests. Robins, wood thrushes, and vireos weave in pieces of paper or cloth, to disguise their nests.

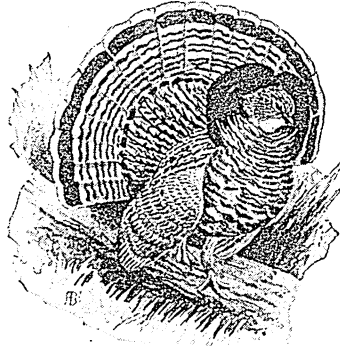
In selecting their nesting material, birds ordinarily take that which is nearest at hand, so long as it conforms to the type of the nest which that species builds. Thus field birds ordinarily use grasses and hairs, woodland birds use leaves and rootlets, and marsh birds use sedges and cattails. Birds like the oriole, therefore, which ordinarily use plant fibers, are quick to avail themselves of strings or yarn put out for them.

COURTSHIP OF HUMMING-BIRDS



When the Humming-bird is courting, the lady sits on a twig while her little knight flies over her backward and forward in a circle. Each time he passes her he swoops sharply coming as near her as possible.

A GROUSE DRUMMING



This Grouse is sending a "wireless" message to the lady Grouse of the neighborhood by beating the air with his wings. This produces a peculiar whirring noise, easily recognized at a considerable distance.

highest type of nest is perhaps the beautifully woven structures of the oriole, hung at the tip end of a branch, though many of the simpler nests show curious specializations. The nest of the humming-bird and that of the wood pewee, for example, are covered on the outside with lichens and bits of bark, so

boxes instead of holes in trees; and the phoebe, that nests under bridges instead of on rock ledges; the barn and cliff swallows, that have deserted the cliffs for human habitations; and especially the omnipresent house sparrow, are examples of this power of adaptation.

How Long it Takes to Build a Nest

The time used to build a nest depends upon how much time the bird has before its first egg is ready to be laid. With ordinary birds the time required is about a week; but there have been many instances—when the first nest has been destroyed and the eggs are ready to be laid—of birds building their entire nests in a day. Occasionally birds that are permanent residents, such as the chickadees, or that arrive early in the spring, as do the phoebes, begin their nests long before the eggs are mature, and consume several weeks in building a structure that could be completed in a few days if necessary. At times certain birds simply mend old nests left the year before.

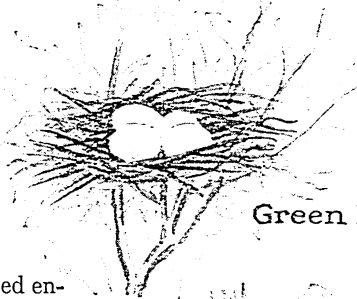
The eggs of birds are among the most beautiful creations of all nature. They vary in color from those



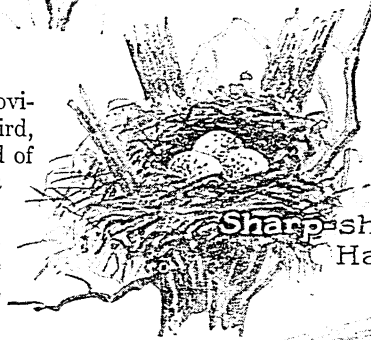
Murre

that are as white as snow to those that are almost black, but the majority have a ground color of some delicate tint and are spotted or streaked with much darker colors. The yolk of the egg is formed entirely in the ovary of the mother bird, the albumen in the upper two-thirds of the oviduct, the shell in the lower third, and the color in the lowest end of the oviduct or else in the cloaca just before it passes out.

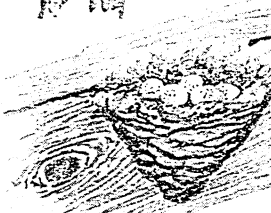
Many theories have been advanced to account for the coloration of eggs. It is almost certain that the color, as originally developed, was of some value to the eggs, probably in rendering them less conspicuous; for eggs like those of the woodpeckers and kingfishers, that have always been laid in dark holes where the color would not be seen, are pure white. Eggs such as those of the plovers and terns, on the other hand, that are laid in exposed places with no protecting nest, are colored like the soil or gravel and are very difficult to



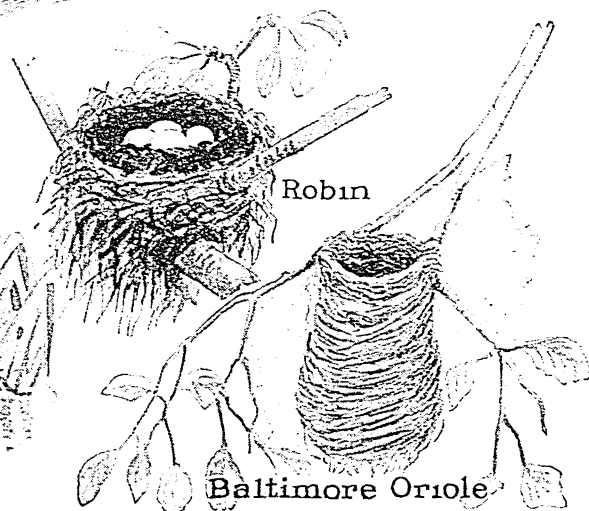
Green Heron



Sharp-shinned Hawk

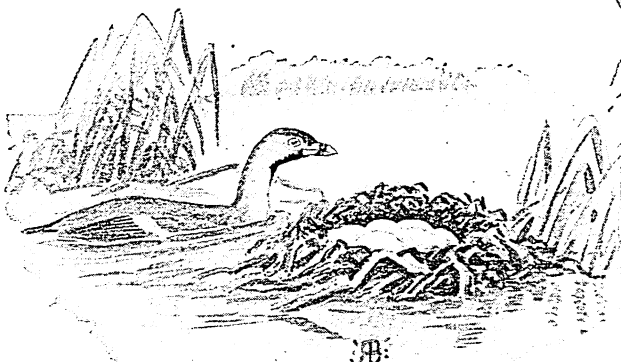


Barn-Swallow



Robin

Baltimore Oriole



Pied-billed Grebe

Fashions in nest building vary widely, as you can see here. That curious sea-bird the Murre solves the problem by not making a nest at all. Her single egg is laid on bare rocky cliffs, but its peculiar top shape insures its safety, for as soon as it starts to roll, it swings around in a circle. You can trace the development of nest architecture in the other pictures, from the crude bundle of twigs piled roughly together by the Green Heron, to the wonderfully elaborate weaving done by the Oriole.

find. The majority of eggs, however, that are laid in nests, seem to be conspicuously marked rather than otherwise, for they are white or some light tint in ground color. In such nests there is no need for protectively colored eggs, because the bird ordinarily selects a site where the whole nest will be inconspicuous and thus hides her eggs at the same time. Thus it has come about that, with the evolution of nests, the need for protectively colored eggs has disappeared and the pigment has gradually degenerated, causing the many beautiful but conspicuous eggs that we find today. Indeed, it is the writer's belief that it is an advantage for nest-building birds to have conspicuous eggs; for if there is an enemy living in the vicinity that will sooner or later discover the nest, it is to the bird's advantage to have it broken up as soon as possible so it can go elsewhere and try again before the season is too far advanced. If the nest remains safe through the first few days when the conspicuous eggs are left exposed, it stands a good chance of remaining safe through the entire period.

Number and Size of Eggs

It requires about 24 hours for an egg to be formed, so that ordinarily one egg is laid each day, at about the same time, until the normal number for the species is complete.

This number varies according to the dangers to which the eggs and young are exposed. Many sea birds that nest on inaccessible cliffs lay but a single egg, while the majority

of game birds and water fowl, that have numerous enemies, lay from 10 to 20. The usual number for most birds is from three to five. If the last egg is removed from a nest as often as laid, the bird's ovary is sometimes stimulated to keep forming eggs in an endeavor to secure the normal number in the nest before the bird begins to incubate. Thus a flicker laid 74 eggs in 71 days, and the domestic fowl has been known to lay as many as 360 eggs in a year.

The size of eggs is fixed for each species, and varies from that of the humming-bird, which resembles a small bean, to that of the ostrich, which is between five and six inches in diameter. Occasionally, with very old domestic fowls or at the close of the egg-laying period, very small eggs are laid. Occasionally also two or even three eggs become enclosed in a single shell, forming the so-called "double-yolked eggs." These abnormalities occasionally occur also with wild birds. In general the size of the eggs varies with the size of the bird, but birds whose young are hatched blind and helpless lay much smaller eggs than those whose young are covered with down and able to run about when hatched. Thus the catbird and the spotted sandpiper are about the same size, but the egg of the sandpiper is about twice the size of that of the catbird.

How the Egg Becomes a Bird

With the laying of the last egg most birds begin to incubate, but a few like the owls begin to incubate with the laying of the first egg, causing the young to hatch on different days. The time required for eggs varies with the size of the egg, though for some reason a few small eggs require a longer time than some of the larger ones. Thus, while the eggs of the red-winged blackbird require but 12 days, and the eggs of the robin but 14, the eggs of the humming-bird require 15 days to hatch. Hen's eggs require 21 days, ducks' 27, geese's 35, etc. In addition to being maintained at a constant temperature by the heat of the bird's body, the eggs have to be regularly turned by the old bird, and occasionally moistened to keep the pores in the shell open and the membranes which line the shell moist so that the embryo can breathe.

With most birds the work of incubation is performed entirely by the female, the male either feeding her on the nest or standing guard by the nest while she flies off to feed. With dull-colored or sparrow-like species, in which the males are as dully colored as the females, the males share the duties of incubation; and the same is true of a few brightly colored birds, like the rose-breasted grosbeak.

There are two types of young birds—those that remain helpless in the nest for some time, and those which can run about as soon as hatched. The first

class are hatched blind and helpless, with only a scant covering of down. Their parents build well-formed nests in which they remain for varying lengths of time—from a week in such ground-nesting species as the vesper sparrow and horned lark, to a year in such birds of flight as the condor and the wandering albatross. The young of the second class, on the other hand, like those of the domestic fowl, are fully covered with down when hatched, have their eyes open almost immediately, and are able to follow their parents about in their search for food. They remain in the nest only a few hours, and their parents must, therefore, be birds that live on the ground or in the water.

Taking Care of the Young

All young of the helpless type are fed at first on partially digested food brought up from the crop of the parent bird. Doves, petrels, albatrosses, and a few other birds continue this method of feeding as long as the young require care; but the majority of birds soon begin to bring fresh food to the young. This is usually carried in the bills or in the talons of the old birds; but herons, humming-birds, waxwings, and a few other birds continue to carry the food in their crops although it is not all digested.

The food of most young birds consists of insects at first, this being varied later by fruits or even seeds with some species. The insects are placed far down into the throats of the young birds, which normally stretch up their necks and open their mouths widely at the approach of their parents. Swallowing is entirely automatic, and unless food is placed beyond the base of the tongue, the muscles do not act and the food remains in the open mouth unswallowed. There is likewise a nervous

adjustment to prevent the young from being overfed, for after each has received sufficient food, the throat muscles refuse to work and the food remains unswallowed. After feeding, the parent bird always inspects the mouths of the young, which usually remain wide open, and if any food remains unswallowed, she removes it and gives it to one of the other young. As stated in the paragraphs on economic importance, the amount of food taken by young birds is surprising, for they require from one-half to their full weight of food each day in order to grow. To keep up this supply both parents work from early morning until nearly dark. In a few cases, like that of the humming-bird, the male bird never assists in the care of the young; but in most cases, the male is even more industrious than the female, and is likewise more courageous in the presence of danger.

After each feeding the nest is regularly inspected and all excrement is removed, so that the nest is

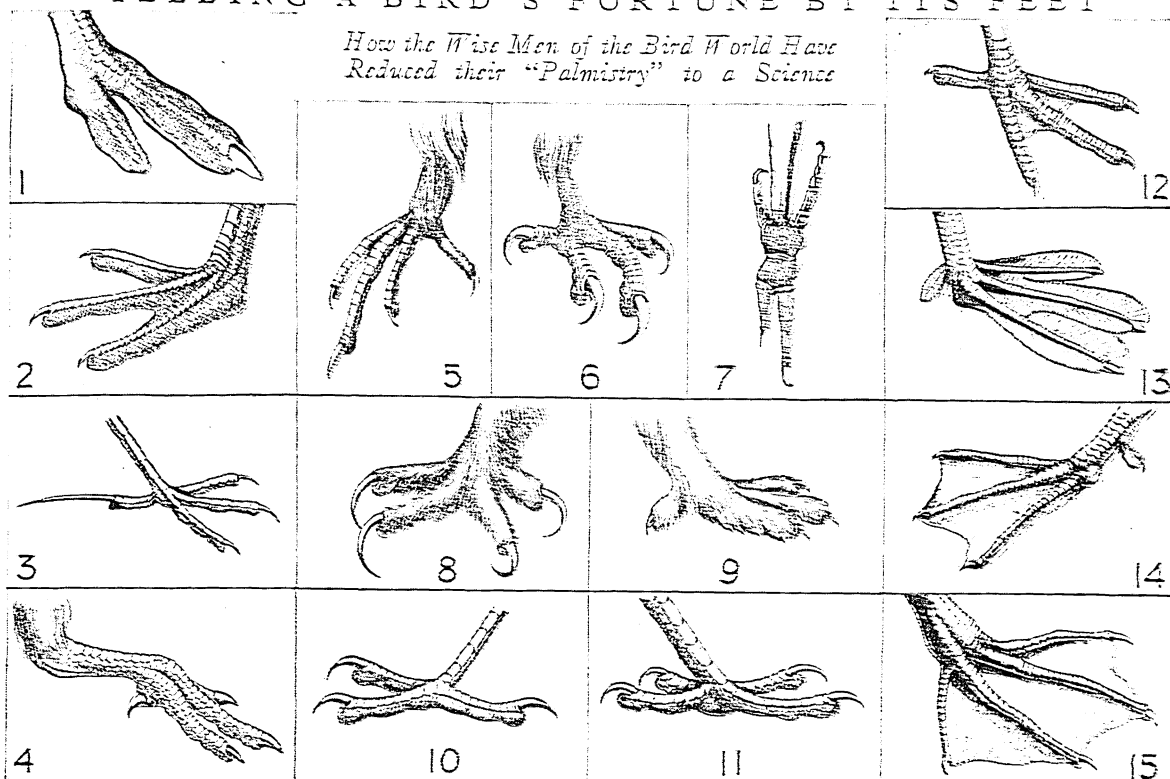
BABY BITTERNS.



The babies in a Bittern's nest "come in sizes." The reason for this is that the parents begin hatching the eggs just as soon as Mrs. Bittern has laid the first.

TELLING A BIRD'S FORTUNE BY ITS FEET

*How the Wise Men of the Bird World Have
Reduced their "Palmistry" to a Science*



The study of feet among the birds may be called a scientific kind of "palmistry," for it tells a great deal about their lives, as the palmists pretend to do about the lives of human beings by looking at the lines in their hands. Here is what a bird "palmist" would say to an Ostrich on looking at that foot of his (1): "Your grandparents of some millions of years ago had five toes. The other three have disappeared because your family have put in so much time running. The third toe has grown very big, while the fourth toe, the only other one you have left, is dwindling. In the case of your grandchildren it will probably disappear altogether, just as happened with the horse."

Another thing the "palmist" would say to all these birds whose feet we see before us is: "Pardon me,—it doesn't sound like a nice thing to say to you—but your early ancestors were repiles." He knows it by those scales, except in the case of the Tawny Owl (8) and the Ptarmigan (9), whose legs and toes are covered with feathers. All the other feet are scaled: Plover (2), Skylark (3), Apteryx (4), Night-jar (5), Sea Eagle (6), Toucan (7), Three-toed Woodpecker (10), Green Woodpecker (11), Stork (12), Grebe (13), Merganser (14), Pelican (15).

Feet 12 to 15 are clearly those of birds that frequent the water. In the Stork (12) the web reaches only to the first joint. In the Grebe (13) the web is attached to each toe, but these toe webs do not join. This makes it convenient for walking as well as swimming. Although Plovers (2) are water birds, they wade along shallow shores and so, instead of webbed feet for swimming, have long toes to distribute their weight as they walk over the sand and mud. A Woodpecker's feet (10 and 11) are arranged to give them a good grip on tree trunks. Toucans (7) like the Green Woodpecker have two toes projecting forward and two backward, while the Owl (8) can turn his third toe either backward or forward, as he chooses.

kept scrupulously clean. Flesh-eating and fish-eating birds are exceptions to this rule, and their nests often become quite foul.

Clothes of the Bird and How They are Changed

A few young birds of the helpless type, such as flickers and pelicans for example, are absolutely naked when hatched, but the majority have a scant covering of down on the back and on the top of the head. Feather growth starts immediately, and within a week or 10 days the majority of small birds are fully covered with feathers, and within 10 days or two weeks are able to fly. The largest birds of flight, however,—the condor and the albatross—as already indicated, do not learn to fly for nearly a year.

The first covering of all young birds is called the *natal plumage*. The covering of the fledgling is called the *juvenal plumage*, and it is worn only a short time after leaving the nest. It is then replaced by the *first winter plumage*. These feathers are worn through-

out the winter; but, in the case of most birds, towards spring they are replaced by the first breeding or *nuptial plumage*. This is worn throughout the breeding season, being replaced again in the fall by the winter plumage.

The change from one plumage to another is called a *molt*, and takes place very gradually. When a bird is in good health only a few feathers are shed at a time, and these are replaced before others are shed, the whole process requiring from one to two months. The molt always begins at a definite place on the bird's body, and the feathers are lost in a regular order. Thus, in the wing, the first feather to be lost is always the innermost primary feather, and when the new feather replacing it is about half grown, the next one is shed; and so on, so that the bird is never deprived of the power of flight. In a few swimming and diving birds, that are not entirely dependent upon their wings for escape, all of the flight quills are shed at one

time, and for a time the birds are unable to fly; but this is an exceptional form of molting. The summer molting season usually begins in August and continues through a part of September. This is the most difficult season of the year to study birds, because during the molt they stop singing, seek seclusion, and many species seem to disappear altogether. During this molt every bird changes every feather on its body, and most birds that have been brightly colored during the breeding season now assume sober colors. Thus the male of the scarlet tanager, which during the summer is bright red with black wings and tail, now becomes green like the female, except that his wings and tail still remain darker than hers. During the spring molt, only such feathers are replaced by birds as are necessary to bring them into breeding colors. Thus the scarlet tanager does not shed its wing and tail feathers, for they are the same in both plumages. Birds which have the same color in winter as in summer usually do not have a spring molt, since the feathers are not yet sufficiently worn to make the physical strain of molting worth while. Some birds appear to change their colors without molting by a process called *feather wear*. This occurs only with such birds as have their new feathers edged with brown or gray; for these edges, by their overlapping, conceal the underlying main color of the feather. Thus the rusty blackbird appears largely brown in its winter plumage, but as spring approaches and the brown edges wear off, it gradually becomes blacker until, by the time the breeding season has arrived, its feathers are like jet. Often some prominent mark is concealed in this way during the winter, as for example the black throat patch of the male house-sparrow. This is a narrow spot all winter, but by May or June the entire throat is black.

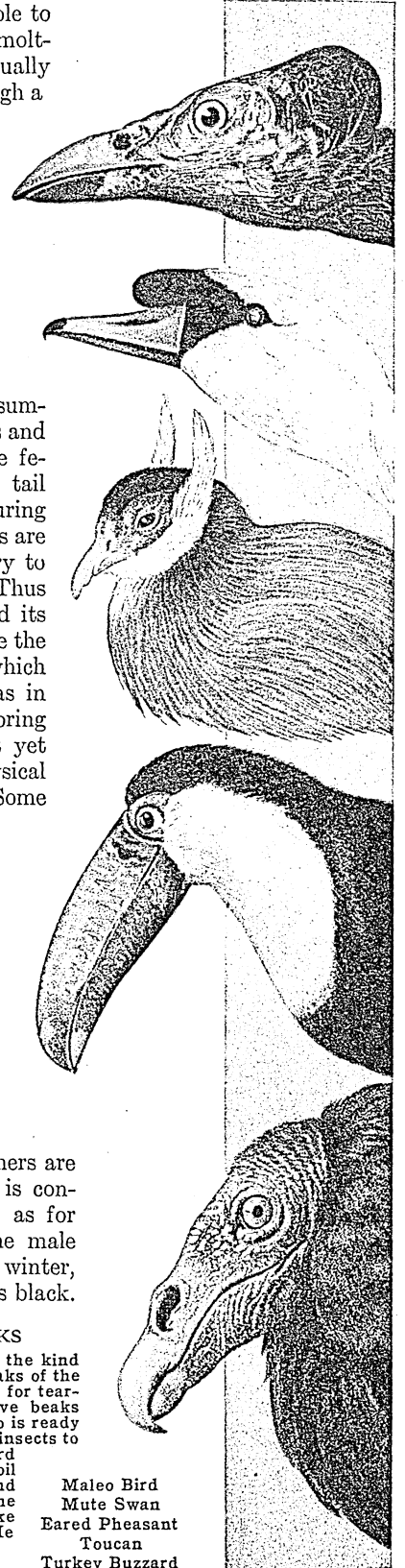
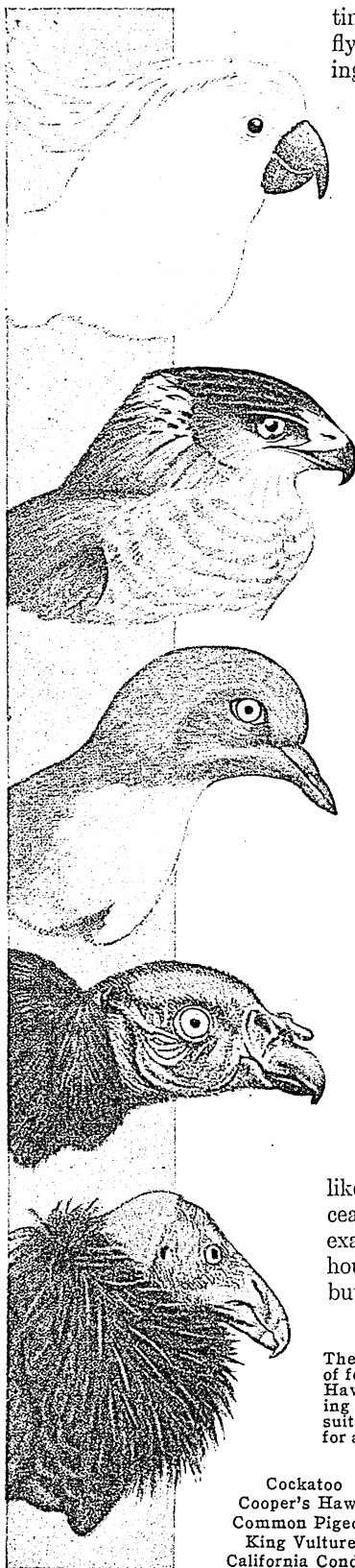
READING CHARACTER IN BEAKS

The shape of a bird's beak depends chiefly on the kind of food it eats. We can see plainly how the beaks of the Hawk, Vulture, Condor, and Buzzard are made for tearing meat. The Pigeon and the Pheasant have beaks suited to picking up small seeds. The Cockatoo is ready for almost any diet, from nuts and hard-shelled insects to small lizards and fruit. The Maleo Bird of the Celebes Islands digs in the soil for his dinner. The Swan can cut and crush the roots of water plants. But the Toucan's huge beak, formed inside like a dry, light sponge, is a mystery. He eats ordinary fruits and insects.

(Painting by Jean Eltwein)

Cockatoo
Cooper's Hawk
Common Pigeon
King Vulture
California Condor

Maleo Bird
Mute Swan
Eared Pheasant
Toucan
Turkey Buzzard

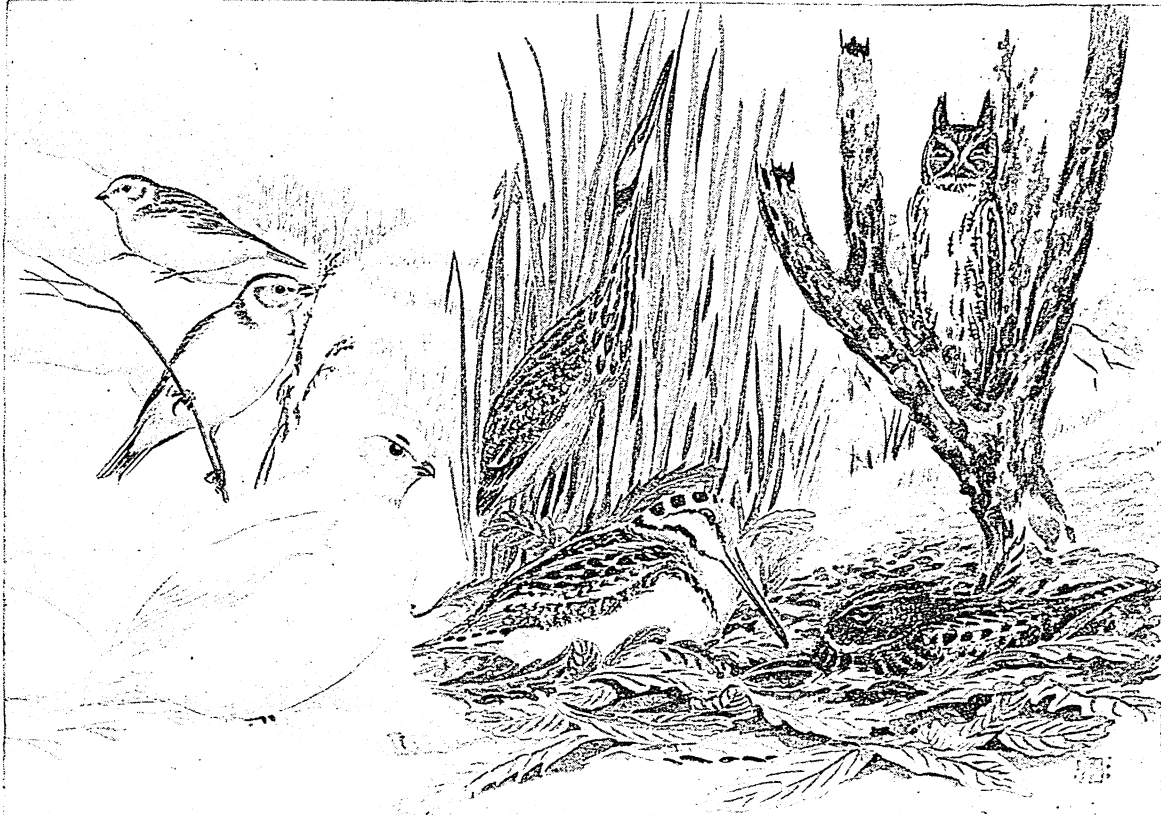


It is impossible to imagine a color that could not be matched by the plumage of some bird, but in spite of this fact there are only four pigments or color substances found in the feathers of birds—black, brown, red, and yellow. In a small group of African birds called turacos, a green pigment also is present; but all other greens, and all blues and metallic colors, are due to the *structure* of the feathers rather than to pigments. It is usually the superficial layers of cells that are prismatic in shape and cause the refraction

birds appear much redder than the normal coloration, irrespective of age or sex. This is well shown in the red and gray phases of the common screech owl and in certain other dull-colored species.

When there is a difference in the coloration of the male and the female bird, it is usually the male that is brighter. Among North American birds, the *phalaropes* (a group similar to the sandpipers) are exceptions to this rule, the females being brighter than the males. It is interesting to note in this case

HOW BIRDS PRACTICE CAMOUFLAGE



You might wonder why those two Snow Buntings aren't all white, but don't you see how those dark patches of color would help them to blend in with a background of snow-covered bushes, so that a Hawk, for example, away up in the sky, couldn't make them out at all? The Ptarmigan, just below, is all white because he sits directly on the snow. The Bittern, with his head straight up among the tall grass of a marsh, is easily confused with his surroundings; and the same is true of the blending of the Woodcock's markings and the dead leaves. The Screech Owl sitting in the daytime on a dead tree, looks to be a part of it, while the Whippoorwill crouching below seems a part of the mottled soil.

that gives the color to the feather. To see the color at its best, therefore, the observer has to be in good light with the sun at his back. It is for this reason that a bluebird appears black when it is between one and the sun, and it is also for this reason that it is often difficult to identify the birds one sees under unfavorable light conditions.

Occasionally birds are seen whose feathers are deficient in pigment. There may be only a few white feathers in the plumage, or the entire bird may be spotted, or it may be entirely white. In the latter case it is said to be a pure *albino*. Albinism may occur in any species. In a few species the red pigment occasionally becomes overdeveloped and the

that the males incubate the eggs and care for the young, while the females go off by themselves; for it is believed that the dull coloration of most females is due to the need for being inconspicuous on the nest. Added strength is given to this belief by the fact that in the families of birds that always nest in holes, notably the woodpeckers and kingfishers, the females are just as brilliant as the males. Being out of sight when incubating they do not need to be protectively colored.

When the males and females are colored differently in the breeding season, the male in its winter plumage usually takes on a coat very similar to the female. It is for this reason that so few brilliantly colored

birds are seen during the fall migration and during the winters spent in the south.

When the male and female differ in color, the young birds in juvenal plumage usually resemble the female. If both sexes are alike, the young are similar, unless the adults differ in coloration materially from the other members of the family. In such cases the young often show the characteristics of the family. Thus young robins and bluebirds have the spotted breasts characteristic of the thrush family, and young field and chipping sparrows have the streaked breasts of the sparrow family, although the adults in both cases have unmarked underparts. The juvenal plumage is usually lost after the first winter, in time for the first breeding season; but a few birds like the redstart and orchard oriole do not change until after the breeding season. It is for this reason that one often sees individuals that seem to be females of these species singing, though they are in reality young males.

Bird "Camouflage"

When one begins the study of birds he very soon realizes that some birds are much more easily seen than others. He soon learns that certain birds, such as the tanagers and warblers, are quite conspicuously marked; while others, for example the sparrows and shore-birds, are protectively colored. The conspicuously marked birds are ordinarily shy birds and do not permit of very close approach, while those that are protectively colored will often allow you almost to step on them before taking wing.

This form of "camouflage" among birds is an interesting example of the manner in which Nature safeguards animals from their foes (see Protective Coloration).

There are today between 13,000 and 14,000 species of birds found in the world, of which 766 are found in North America north of Mexico. Before anyone can handle conveniently any such large group of

objects or facts, it is necessary that they be systematically arranged, and this arrangement is called classification. Just as the books in a library are classified and placed on shelves according to their contents and relationships, so in the classification of birds—and indeed of all animals—the endeavor is made to put similar animals together in groups, and similar groups together in larger groups, etc. And just as in the library the books are not arranged according to their size or the color of their covers, so with birds—their classification is based upon their *structure* rather than upon external similarity.

Beginning with the largest groups, we find that the *animal kingdom* is divided into a number of *phyla* (from the Greek word meaning "tribe") or branches, of which the birds, together with the mammals, reptiles, amphibians, and fishes belong to the highest group, called *Chordata* or back-boned animals, as opposed to the insects, mollusks, crustaceans, etc. Each phylum is divided into a number of *classes*, the birds belonging to the class *Aves*. Each class in turn is divided into a number of orders, and these are again divided into *families*. Twenty of these orders are represented by the birds of North America north of Mexico as given in the accompanying table.

Some of these families are represented by only one or two species in North America, while others contain 40 or 50. In the larger families certain species are always more like each other than like the other members of the family, and so it has been found convenient to divide each family into *genera* (singular, *genus*). Thus in the thrush family we have a genus to include the various bluebirds, another to include the various robins, another to include the various thrushes, etc.

A species has been defined as a group of individuals that resemble each other as the offspring of a single parent, and would naturally be the smallest division necessary for all ordinary usage. However, in studies of the distribution of birds, it has been discovered that species

of birds that have a wide range over the continent usually vary in different parts of their ranges, and, in order to show to which local race an individual bird belongs, it has been necessary to divide the species into sub-species or varieties.

ORDERS OF AMERICAN BIRDS

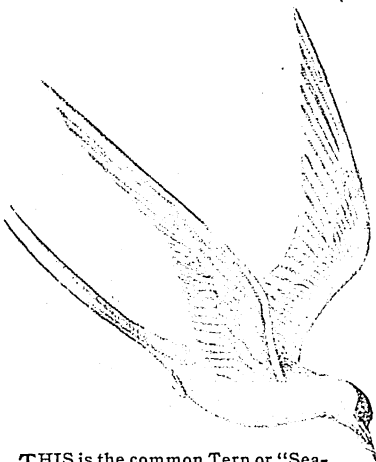
- I. Order *Gaviiformes*: Loons.
- II. Order *Colymbiformes*: Grebes.
- III. Order *Procellariiformes*: Albatrosses, Shearwaters, Fulmars, Petrels.
- IV. Order *Pelecaniformes*: Tropic-birds, Pelicans, Boobies, Gannets, Cormorants, Darters, Man-o'-war birds.
- V. Order *Ciconiiformes*: Herons, Bitterns, Egrets, Storks, Ibises, Spoonbills, Flamingos.
- VI. Order *Anseriformes*: Swans, Geese, Ducks.
- VII. Order *Falconiformes*: Vultures, Kites, Eagles, Hawks, Ospreys, Caracaras, Falcons.
- VIII. Order *Galliformes*: Guans, Grouse, Quails, Pheasants, Turkeys.
- IX. Order *Gruiformes*: Cranes, Limpkins, Rails, Gallinules, Coots.
- X. Order *Charadriiformes*: Oyster-catchers, Plovers, Turnstones, Surf-birds, Snipes, Sandpipers, Curlews, Godwits, Dowitchers, Willets, Avocets, Stilts, Phalaropes, Jaegers, Skuas, Gulls, Terns, Skimmers, Auks, Murres, Puffins.
- XI. Order *Columbiformes*: Pigeons, Doves.
- XII. Order *Psittaciformes*: Parrots, Paroquets, Macaws.
- XIII. Order *Cuculiformes*: Cuckoos, Roadrunners, Anis.
- XIV. Order *Strigiformes*: Owls.
- XV. Order *Caprimulgiformes*: Goatsuckers, Nighthawks.
- XVI. Order *Micropodiformes*: Swifts, Hummingbirds.
- XVII. Order *Trogoniformes*: Trogons.
- XVIII. Order *Coraciiformes*: Kingfishers.
- XIX. Order *Piciformes*: Woodpeckers.
- XX. Order *Passeriformes*: Perching Birds, including almost half the known species.

Each order is divided into one or more families. Thus the order *Passeriformes* is represented by some 25 families in North America, as follows: *Tyrannidae*, Tyrant Flycatchers; *Alaudidae*, Larks; *Hirundinidae*, Swallows; *Corvidae*, Jays, Magpies, and Crows; *Paridae*, Titmice, Verdins, and Bush-Tits; *Sittidae*, Nuthatches; *Certhiidae*, Creepers; *Chamaeidae*, Wren-Tits; *Cinclidae*, Dippers; *Troglodytidae*, Wrens; *Mimidae*, Mockingbirds, Catbirds, and Thrashers; *Turdidae*, Thrushes, Bluebirds, and Solitaires; *Sylviidae*, Gnatcatchers and Kinglets; *Motacillidae*, Pipits and Wagtails; *Bombacillidae*, Waxwings; *Polioptilidae*, Silky Flycatchers; *Laniidae*, Shrikes; *Sturnidae*, Starlings; *Vireonidae*, Vireos; *Comptolypidae*, Wood Warblers; *Ploceidae*, Weaver Finches; *Icteridae*, Meadowlarks, Blackbirds, and Troupials; *Thraupidae*, Tanagers; *Fringillidae*, Grosbeaks, Sparrows, and Finches.

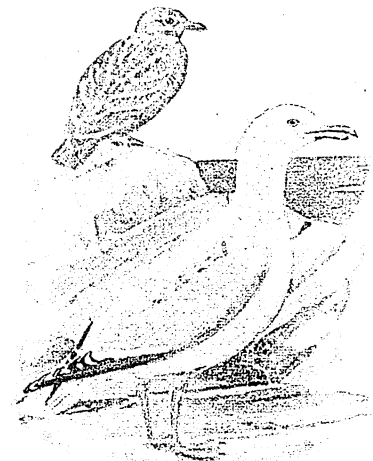
LEADING FAMILIES *Among Our* BIRD PEOPLE



VERY bird in the world belongs to a tribe, and each bird tribe or order has some peculiar structure of foot or beak or wing that distinguishes it from all others. Once you know these marks, birddom becomes a book of never-ending interest. These pictures are selected and arranged to bring out all the more important orders of our American birds with their distinguishing marks. The articles appearing on other pages under each bird's name should also be consulted.



THIS is the common Tern or "Sea-Swallow" (*Sterna hirundo*) that tells the fisherman where to cast his nets. Feeding on the small fry that are driven to the surface by their larger foes, the Terns gather in screaming thousands over passing schools of fish. In snatching their prey from the waves they rarely wet more than their heads and necks. The Terns belong to the order *Charadriiformes*, which includes also Gulls, Jaegers, Skimmers, Shore Birds, Auks, Murres, and Puffins.

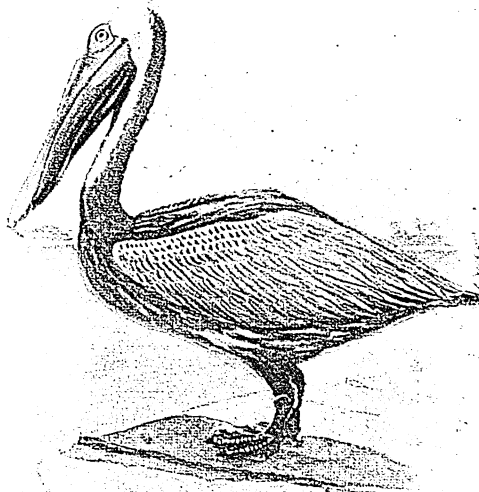


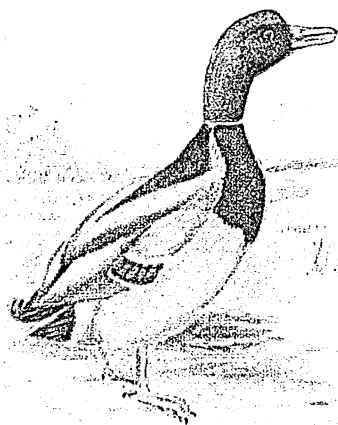
SQUARE tails, larger and stockier bodies, broader and less pointed wings—these marks distinguish the Gulls from their close relatives, the Terns. The Herring Gull (*Larus argentatus smithsonianus*), shown here with its darker colored young, is one of the commonest of the Gull family. Besides fish, it also feeds on carrion or on any scraps of food thrown overboard by ships. It is the most familiar bird in large harbors, where it boldly flashes its brilliant white breast in the wake of churning vessels, or rides the choppy waves like a cork. It is a skillful opener of clams, dropping them again and again from high in the air to the hard beach, until the shells crack.

BEGINNING with water birds, we see first the Pied-billed Grebe or "Hell-diver" (*Podilymbus podiceps*), a far better swimmer than any duck. Like a submarine it can float with its whole body showing, or sink until only its sharp eyes are visible. The Grebes, or lobe-footed divers, form the order *Colymbiformes*. Other common members of this group are Holboell's Grebe, the Horned Grebe, the Eared Grebe, and the Western Grebe.

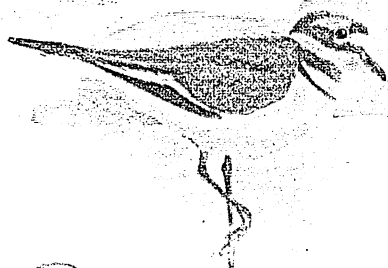


THE solemn-looking bird below is the Brown Pelican (*Pelecanus occidentalis*), bulky, powerful of wing, and a great fisherman. It flies low over the water, turning its head from side to side in the most comical manner, and plunging in like a stone when it sights a flash of silver near the surface. Its appetite is enormous, and when it can swallow no more, it fills the great pouch beneath its beak with fish to be eaten later at leisure or to be fed to its young. Often the Laughing Gull, a relative of the bird in the next corner, watches until the Pelican is struggling with a new-caught fish, then alights on its great beak and snatches the prey away. Pelicans frequently travel across country in regular wedge-shaped lines, beating their wings in perfect unison. The White Pelican is a more showy bird than the brown, and is commoner in northern regions. Pelicans are members of the order of yoke-toed swimmers (*Pelecaniformes*), which have all four toes joined by webs. The Gannets, the Darters or "Water Turkeys," the Cormorants, and the Frigate-birds or "Man-o'-War" birds, also belong to this order.

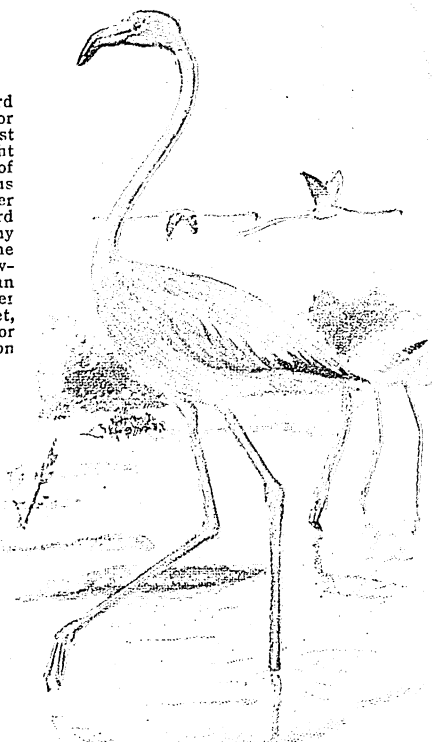




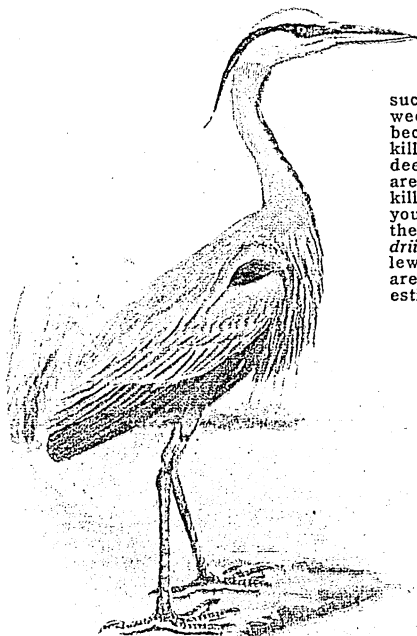
ALL sportsmen know the Mallard Duck (*Anas platyrhynchos*), for it is the chief water-fowl of most wild duck preserves. The bright green head and vivid markings of the male make him a conspicuous figure on our northern water courses, but the female Mallard wears dusky brown and tawny plumage. Like all ducks, the Mallard has a round bill with saw-tooth edges, webbed feet, and an awkward waddling gait—the latter due to the fact that ducks' feet, which are designed especially for swimming, are placed far back on the body.



HERE is an active little bird (*Oxyechus vociferus*) that helps us by eating harmful insects, such as mosquitoes, fever ticks, and weevils. It is called the Killdeer because it keeps calling "Kill-dee, kill-dee," in a loud shrill key. Killdeers haunt meadows and fields, but are most at home near water. The killdeer's long legs and stout bill tell you that it is a plover. It belongs to the sub-order of shore birds (*Charadrii*). Snipe, Sandpipers, and Curlews, Surf-birds, Stilts, and Avocets are all members of this most interesting group of birds.



OCCASIONALLY this gorgeous bird is seen stalking about in Florida. It is the Scarlet Flamingo (*Phoenicopterus ruber*), and it is the only one of its family (*Phoenicopteridae*) found in this country. Its clumsy-looking bill is really a contrivance for straining its food. The lower part is fitted with holes, so that when the bird reaches down and takes a billful of food—frogs and shellfish—from the mud, the dirt and water run out, leaving its prey behind. For a nest the Flamingo scrapes up a tall mound of mud out of the marsh, with a hole in the top in which to lay its one or two white eggs.

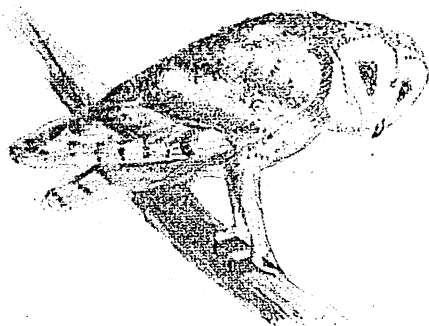
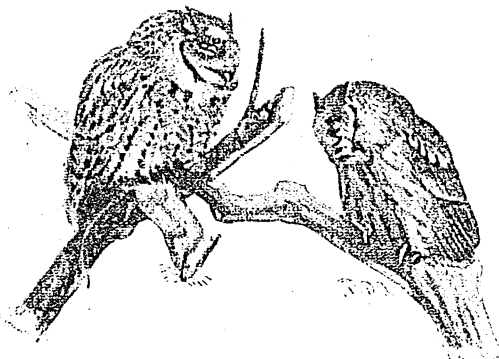
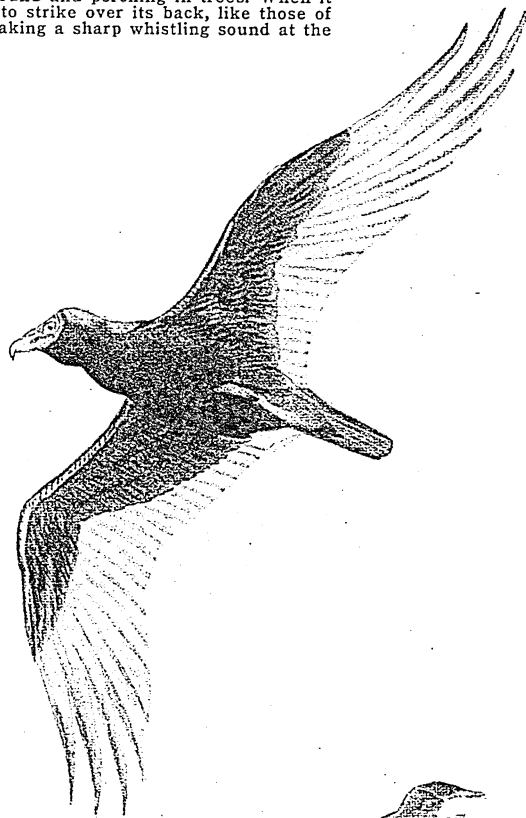
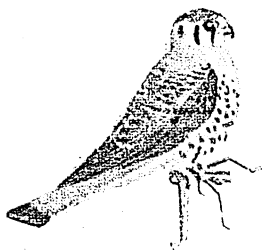
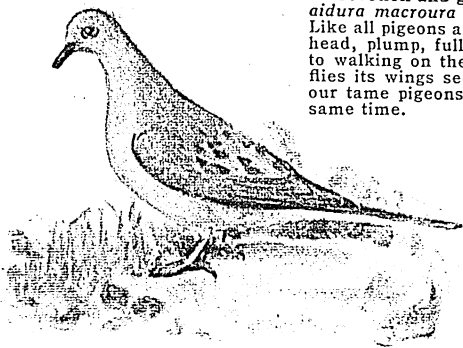


THIS dignified-looking bird is the great Blue Heron (*Ardea herodias herodias*), and he is an expert fisherman. He stands motionless in the shallow water until he spies a frog or fish coming along, then like a flash his long neck straightens out and the luckless fish is caught in his sword-like bill. His long legs are well adapted to wading among the reeds along shore. Like most fishermen the Blue Heron usually prefers to be alone, but at nesting time he and his mate join a colony of Herons that may include as many as 150 nests. Herons belong to the order *Ciconiiformes*, which also includes the Bitterns, Storks, Ibises, Spoonbills, and Flamingos.



BOB-WHITE'S cheery note is one of the most familiar of bird-calls, for almost every farm has its covey of Quail (*Colinus virginianus*). These birds live in flocks and often sleep side by side in a circle on the ground. Bob-White is one of the henlike ground-dwelling birds (*Galliformes*), and he is well fitted for such a life. He can build a nest on the ground so cleverly that it cannot be found, while his brown plumage with its black and white markings blends so well with his surroundings, that when he flattens out in the dry grass or stubble he becomes almost invisible. Pheasants, peacocks, and chickens are other well-known members of the order to which Bob-White belongs.

THE peculiar quality of its call, which suggests both deep devotion and great sadness, has given to this bird (*Zenaidura macroura carolinensis*) the name Mourning Dove. Like all pigeons and doves (*Columbiformes*), it has a small head, plump, full-breasted body, and feet equally suited to walking on the ground and perching in trees. When it flies its wings seem to strike over its back, like those of our tame pigeons, making a sharp whistling sound at the same time.

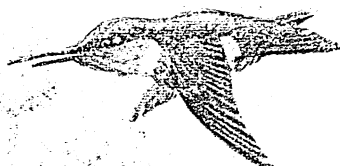


THE Vultures, Hawks, Eagles, Falcons, and Owls were formerly placed in one order (*Raptores*). Because of their structural differences, the Owls are now grouped in a separate order (*Strigiformes*), while the Vultures, Hawks, Eagles, and Falcons are placed in the order *Falconiformes*. The bird with the widespread wings is the Turkey Vulture (*Cathartes aura septentrionalis*), the most common member of the Vulture family in the United States and a valuable scavenger. Left of the vulture a male and female Sparrow Hawk (*Falco sparverius*), which belong to the Falcon group, sit alert waiting the approach of a mouse, grasshopper, spider, or other prey. A white head, neck, and tail, a dusky cloak, a yellow bill, and partly feathered tarsi (shanks)—these marks identify the Bald Eagle (*Haliaeetus leucocephalus*) perched in the lower right-hand corner. This bird subsists chiefly on fish. In the lower left of the page are a pair of round-faced Screech Owls (*Otus asio*), and a Barn Owl (*Tyto alba pratincola*) with its heart-shaped face and big ruff.

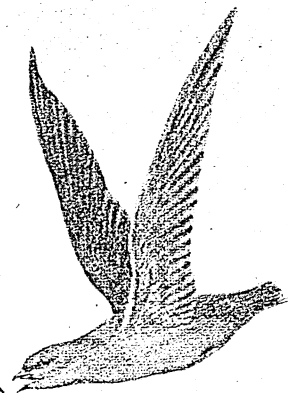


THE Nighthawk (*Chordeiles minor*), pictured at the left, is widely distributed throughout the United States. In the evening you may hear his nasal peent, peent, as he flies erratically above tall city buildings or in the open country. In spite of its name, this bird is by no means a hawk, but belongs to the order *Caprimulgiformes*. The Whip-poor-will and Chuck-will's-widow also belong to this group. The Nighthawk is insectivorous and catches its prey while on the wing.

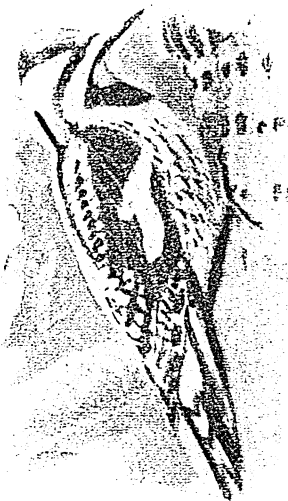
THE Hummingbirds and Swifts are grouped in the order *Micropodiformes*. Representatives of this group are the Chimney Swifts and Ruby-throated Hummingbirds seen at the right in the center of the page and in the upper right-hand corner, respectively. While Swifts are distributed throughout the world, Hummingbirds are found only in the Americas. In the United States these gemlike creatures are most abundant on the Pacific coast, the Ruby-throated being the only species that occurs east of the Mississippi.



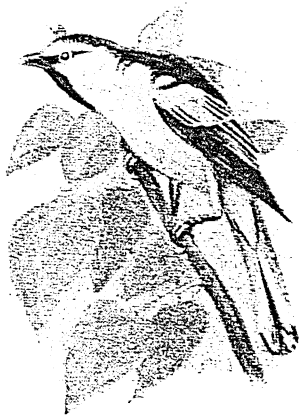
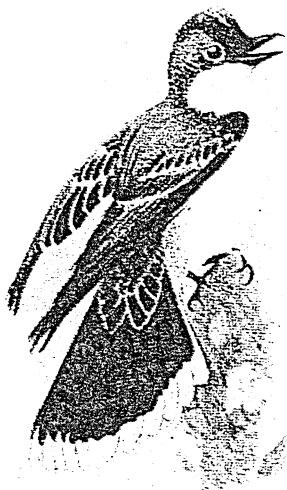
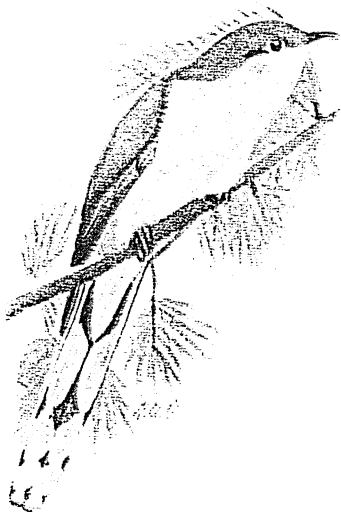
HERE the Ruby-throated Hummingbirds (*Archilochus colubris*) are gathering dandelion down to line their tiny cuplike nest. Only the male has the brilliant ruby-colored throat from which their name is derived.



ABOVE, a group of Chimney Swifts (*Chaetura pelagica*) are hunting insects. Smoky brown plumage, long pointed wings, and a tail ending in spines are the identification marks of this species. These birds live in chimneys, a substitute for their natural homes in hollow trees. They roost and nest in colonies. Their nests, baskets of small twigs glued together with saliva, are gummed to the chimney walls. Most Swifts use saliva in nest construction, and the Swift nests used in soup by the Chinese are made entirely of this substance.



THE Woodpecker's rat-a-tat-tat is the forest rising bell. He clutches the side of a tree, braces himself with his stiff tail, then pounds with his head like a riveter, boring holes so that he can run his long tongue into the bark for grubs. The Northern Flicker (*Colaptes auratus luteus*) is shown in the center. Unlike other members of the Woodpecker tribe (sub-order *Pici*), he often frequents the ground to satisfy his craving for ants. The Downy Woodpecker (*Dryobates pubescens*), at the right, is the smallest and one of the most familiar of the American Woodpeckers, frequenting shade trees, orchards, and woodland. At the left is the Yellow-bellied Sapsucker (*Sphyrapicus varius varius*), which drills many holes in the bark of trees to get at the sap. His tongue is not barbed like those of the other Woodpeckers, but has a little brush on the end with which he laps up the sap.



THE handsome Belted Kingfisher (*Megascops alcyon*), shown in the upper left-hand corner, is a skilled fisherman that haunts the shores of wooded streams and ponds. Of the seven American kingfishers, he is the only one found north of Texas. Kingfishers belong to the order *Coraciiformes*, which also includes the strange Hornbills, Motmots, Rollers, and Bee-eaters. The long slim fellow next to the Kingfisher is the Yellow-billed Cuckoo (*Coccyzus americanus*), a bird of the woodland. His yellow lower mandible, reddish-brown wing feathers, and white-tipped tail are the marks that distinguish him from the Black-billed Cuckoo, which he closely resembles. *Cuculiformes* is the order to which the cuckoos belong. Other birds of this group are the Roadrunners and the Anis.

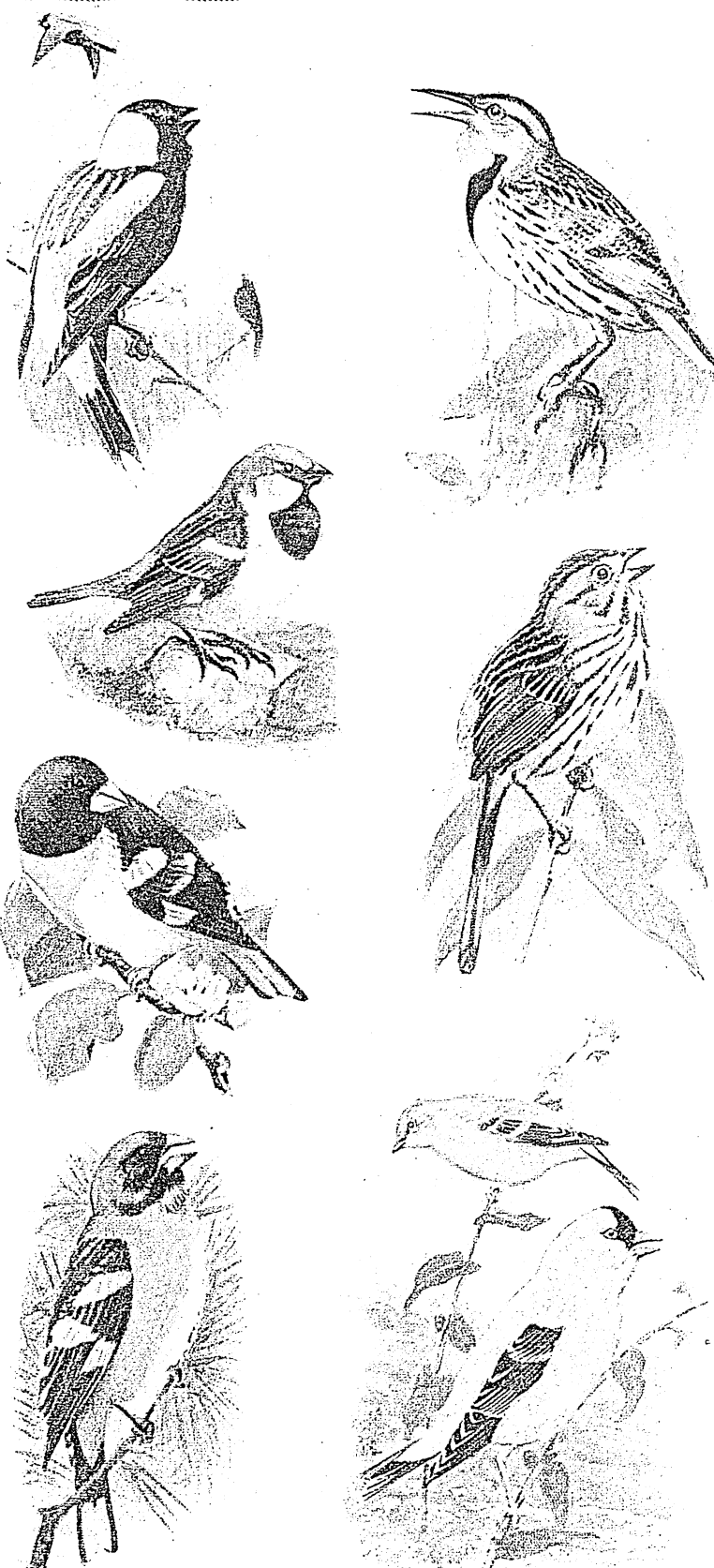
Most of our feathered friends belong to the order of perching birds (*Passeriformes*) the largest of all bird groups. The distinguishing characteristic of the order as a whole is that the four toes are so arranged as to give unusual strength for grasping branches. The last four birds shown on this page and those on the three following pages all belong to this order.

A GOOD representative of the Tyrant Flycatchers is the Eastern Kingbird (*Tyrannus tyrannus*). This is a trim-looking bird, with slate-gray plumage, white-fringed tail, and an orange-colored crest. It is usually seen perched on a fence or low twig, darting out into the air every few moments to seize a passing insect.

THE Red-winged Blackbird, who flaunts his gay plumage in the right center of the page, belongs to the family of *Icteridae*. It nests in colonies in the rushes. While his more soberly clad mate sits on her nest of woven grasses, he swings on the cat-tails and reeds of our marshes and sings o-ka-lee, o-ka-lee.

IN the lower left corner of the page is the Starling (*Sturnus vulgaris vulgaris*), a descendant of the 100 Starlings introduced from Europe in 1890 and 1891. It is cloaked in metallic purple or green, the feathers of the upper parts all being tipped with cream-buff spots. Long pointed wings, square tail, and yellow bill are other identification marks. Its habits are similar to those of the English Sparrow, and already it is contesting the latter's supremacy in many eastern cities.

THE western states are the home of the Bullock's Oriole (*Icterus bullocki*). Although these birds like especially to nest in fruit trees near a house, they can usually be found in the poplars along streams and irrigation ditches. The Oriole's nest is a hanging one of horsehair and fibers, so cleverly woven that it lasts from year to year, and even springs back into shape after being pressed together.



SOMEONE has aptly called the Bobolink (*Dolichonyx oryzivorus*)—another of the *Icteridae*—the “Dr. Jekyll and Mr. Hyde” of birddom. In the spring he comes north in dashing black and white costume, as we see him in the upper left corner, ready to captivate all with his rollicking song as he flits about the meadows searching for insects. But in the fall he dons a dull mottled garb and flies south to the rice fields, where he does great damage to the ripening grain.

QUITE different is the Meadow-lark (*Sturnella magna*), a handsome cheery bird which has the best of habits and destroys many harmful insects. It lives in the fields and builds its nest on the ground under a tuft of grass. It is quickly recognized in flight by the outer white tail feathers that flash in the air. On the ground the Meadow-lark neither hops nor runs; it is one of the few birds that walks. Its three-noted song is one of the sweetest of the bird-calls.

EVERYONE knows that street gamin, the English Sparrow (*Passer domesticus*), shown perched alertly on a stone at the left. Although he was not brought to this country until 1850, he has succeeded in taking almost complete possession of our cities, driving out our native song-birds. He belongs to the family of Weaver Finches (*Ploceidae*). The only other representative of this family in North America is the European Tree Sparrow.

THE Song Sparrow (*Melospiza melodia*) belongs to the largest of the bird families—the *Fringillidae* or Finches. Although this little roadside minstrel has adapted himself to so many varying climates and conditions that he is represented by 23 geographical races, each differing in color and size, we can usually tell him by his breast, which is spotted with black or brownish wedge-shaped streaks and centered by a dark blotch.

ANOTHER member of the Finch family is the Rose-breasted Grosbeak (*Hedymeles ludovicianus*), with his handsome black, white, and rose plumage, one of the loveliest of our summer visitors. He is retiring in habits and stays near his nest in the woods. He is a valuable aid to the farmer in destroying quantities of potato bugs.

THE Black-headed Grosbeak (*Hedymeles melanocephalus*) with his orange-brown breast, is the western cousin of the Rose-breasted Grosbeak. By eating scale insects he helps to save many an orchard crop on the Pacific coast. His happy song can be heard all day long.

THE yellow plumage and sweet song of the Eastern Goldfinch (*Spinus tristis tristis*) have won for him the name “wild canary.” During the early summer he and his mate frolic over the fields and berry patches, and then toward the end of June they gather grass and thistle-down for their home in some low bush. In autumn these birds gather in flocks to travel south for the winter.

HERE are some more representative families of the order *Passeriformes*. The Loggerhead Shrike or "Butcher-bird" (*Lanius ludovicianus*), the first of the series, likes to perch on the top of a small tree, a telegraph pole, or a fence to watch for grasshoppers, snakes, and mice. When he has caught his food he impales it on a thorn to hold it while he is tearing it to pieces with his hooked bill.

THE Swallows all have short flat triangular bills, long strong wings, and tails that are either notched or forked, like the Barn Swallow (*Hirundo erythrogaster*) which is shown in the upper right-hand corner. Once the Barn Swallows nested in caves, but long ago they grew tame and learned to live about barns and sheds, thus getting the name "Barn Swallow." They spend most of their time on the wing, catching insects and eating them as they fly.

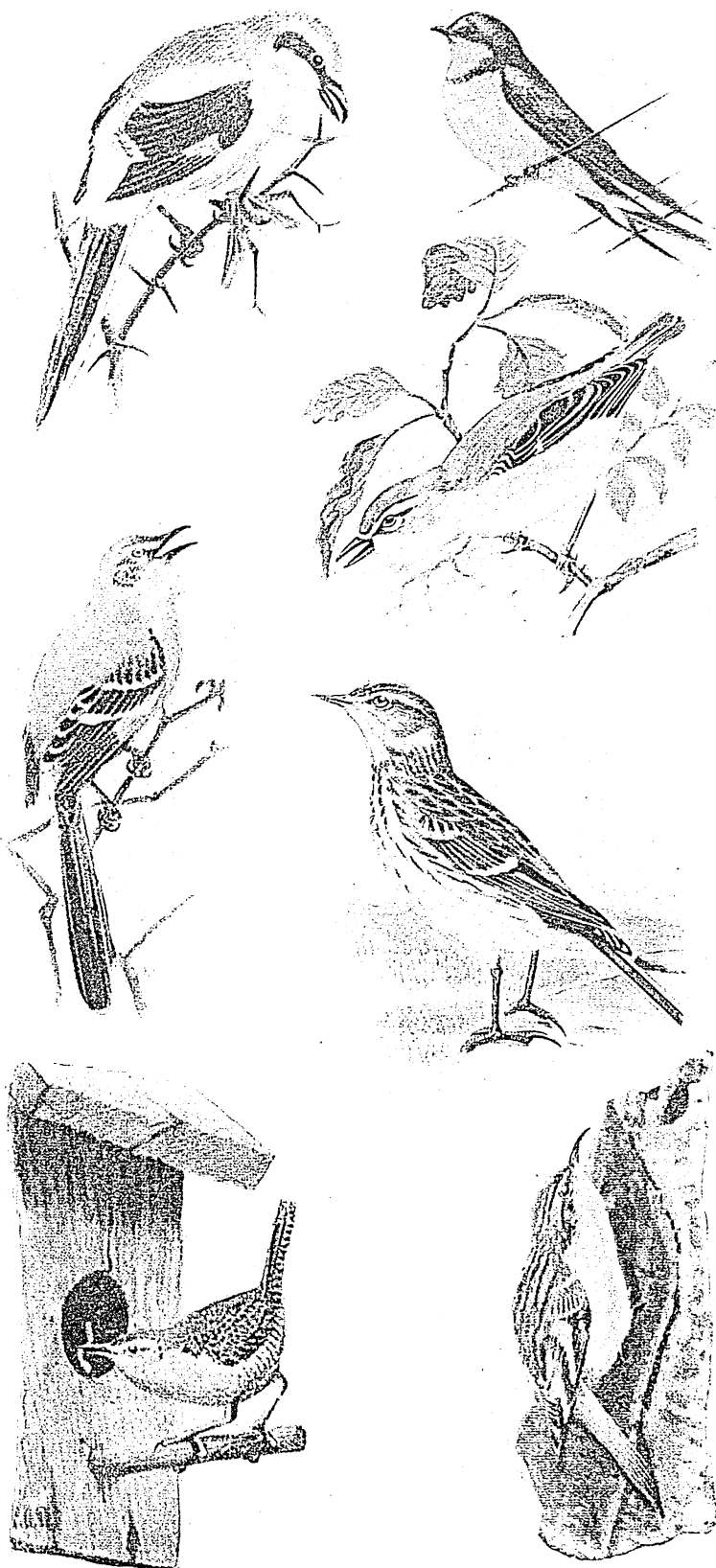
INSECTS on the foliage of trees and shrubs furnish the food for the active little Red-eyed Vireo (*Vireo olivaceus*), which is shown just underneath the Barn Swallow. He is a persistent singer and keeps repeating his song from morning until night. Like others of the vireo family—whose name is Latin for "I am green"—he builds a beautiful hanging nest of finely woven grasses and fibers in the fork of a tree.

THE trills and melodies of the Mocking-bird (*Mimus polyglottos*) make the sweetest of serenades. Nothing is too difficult for this southern songster to attempt; a dog's bark, bird-calls, and even the sounds of instruments are included in his repertoire, and he also has a love song all his own. He is the most accomplished singer of the mimicking birds (*Mimidae*), among whom are included also the Catbird and Brown Thrasher.

SCATTERED flocks of Pipits (*Anthus spinoletta rubescens*), one of which appears below the Vireo, loiter in our pastures and fields on their way south from their summer haunts in Canada. They like the open country and prefer wet fields and bogs. They are ground birds and run about looking for worms and insects. When frightened they fly into the air with great leaps, calling *pipit, pipit*.

THIS mite of a bird is the fussy little House Wren (*Troglodytes aedon*). Jenny Wren knows that she is an excellent housewife and flirts her tail with becoming pride. She will build her nest in any old can or basket that happens to be convenient, if it has an entrance small enough to keep other birds out. Her long curved bill, short wings, and pert tail are characteristic of the wren family, whose name *Troglodytidae* means "cave dwellers."

THE Brown Creeper (*Certhia familiaris americana*)—shown in the lower right-hand corner—is a quiet sort of a bird; and though he and his cousins the Nuthatches are classed as "song-birds" (*Oscines*), because they have vocal organs, they are not real singers. They live on little insects which they find as they scramble incessantly over the trunks and branches of trees.





THE White-breasted Nuthatch (*Sitta carolinensis carolinensis*), on the left, is supposed to get its name from the habit of wedging beechnuts and other nuts in crevices of the bark and breaking them with its beak. It clings to the bark entirely with its claws, for its tail is too short and round to be used as a brace like the Woodpecker's.

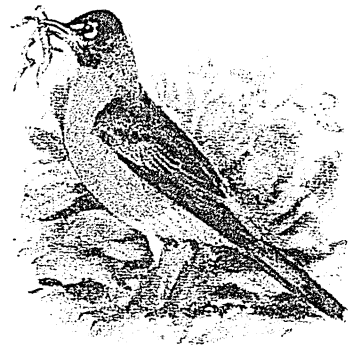
A WINTER snow storm is an opportunity for a romp for the cheery little Chickadee (to the right). Like the Nuthatch, the Chickadee (*Parus atricapillus*) does not mind in the least being upside down as he goes poking over trees for insects. He dresses in plain dull colors, as do the other members of the Titmouse family.



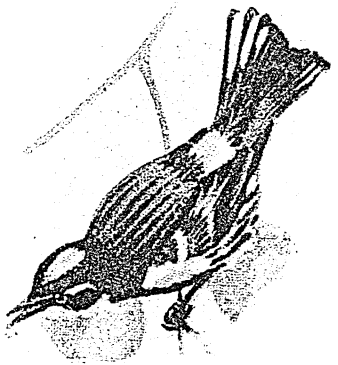
THE Scarlet Tanager (*Piranga erythromelas*) at the left is a gay fellow who flashes through our woods in summer with such brilliance as to merit the name "Fire-bird" sometimes given him. His mate, however, is a modest creature in olive green, but resembling her husband in the blackness of her wings. The song resembles that of the robin. The Tanagers are a distinctively American family. They range from Canada to Argentina.



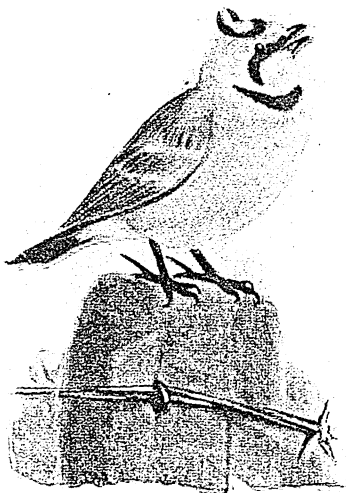
ROBIN Redbreast (*Turdus migratorius*) needs no introduction, for he is the most familiar of our Thrushes. In the spring the children watch for him because he tells them that the winter is over. He is such an affectionate fellow and seems to enjoy human society so much that we gladly forgive him for the cherries and other small fruits that he eats as a dessert to his favorite food, worms.



ITS fondness for myrtle shrubs gives the bird shown beneath the Robin the name Myrtle Warbler (*Dendroica coronata*). It lives in the woods and hedges, where it hunts among the leaves for insects which are its food. The bright yellow patch above its tail distinguishes it from the other Wood Warblers. They all have beautiful plumage in which yellow is the characteristic color, but they are especially known for their sweet caroling songs.



THE Horned Lark (*Otocoris alpestris alpestris*)—lower left-hand corner—along with its many subspecies, is the only member of the true lark family (*Alaudidae*) native to America. He loves the plains and deserts, and his nest is built on the ground in pastures, often before the snow disappears. Like the rest of his family he is an excellent musician, and his jubilant song tells us what it means to be as "happy as a lark."



THE tiny sprite in the right-hand corner is the Ruby-crowned Kinglet (*Corthylio calendula*), who is just as merry a winter bird as his playmate the Chickadee. He is very proud of his bright crest, which he can uncover when he wants to show it off. Indeed the kinglets (*Sylviidae*) receive their name from this patch of bright color on the crown of their heads, which brightens up their otherwise dull plumage of olive, brown, and black. They eat the seeds of weeds and poison ivy, as well as scale insects and other pests.



How to

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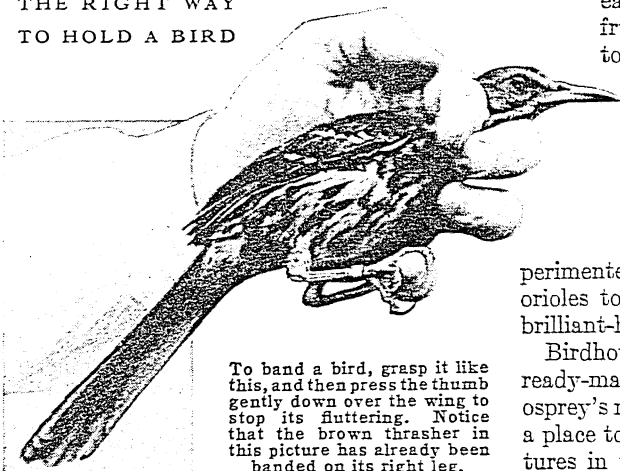
Study Birds

IF WE WANT to attract birds to our homes, we must first make sure that they have a supply of fresh water. Birds need water not only for drinking and bathing, but also to furnish mud for nests. And if they have plenty of water close at hand, they will apparently eat fewer of our cherries and other fruits. In the absence of a brook or pond, a bird bath will go far to supply the lack. This need be nothing more than a pan or a shallow cement pool on the ground. Care should be taken that the bath is not too close to shrubbery in which a cat may lurk.

Winter is the best time for feeding birds, for it is then that insects are hardest to find. Feeding is particularly important after ice storms, but if feeding is once begun it should be continued until spring. Birds should have suet in addition to mixed seeds, such as cracked corn, hemp, millet, and sunflower seeds. To keep squirrels and jays from carrying suet off in large pieces, it may be protected by coarse wire or heavy strong netting, or it may be placed in split coconuts hung from branches.

Feeding Stations and Devices

A tray outside the window, sheltered from rain and snow by a glass roof, is an attractive feeding station. "Weathercock" food stations, which turn on a pole and thus always face away from the wind, are also good. Trays hung by wires completely outwit squirrels, and it is easy to devise automatic food hoppers in the form of inverted bottles filled with seed. A roofed "trolley tray," hung on pulleys from a wire run-

THE RIGHT WAY
TO HOLD A BIRD

To band a bird, grasp it like this, and then press the thumb gently down over the wing to stop its fluttering. Notice that the brown thrasher in this picture has already been banded on its right leg.

A good birdhouse attracts and protects nesting birds and lets you study the young ones as they grow up.

ning from a window to a tree or a post, will enable the observer to pull his guests a little closer each day. Thus he may coax under his eye an extraordinary variety of winter birds, some of which might be too shy to fly up directly.

The feeding devices shown in the accompanying illustrations can be made at home by anyone handy with tools.

Spring and summer feeding is less profitable, because at those seasons most birds, including the seed-eaters, turn to the natural supply of insects and fruits. However, it is possible to lure humming-birds to one's porch all summer by hanging up small bottles filled with sugared water.

Nest Building and Birdhouses

Material for nest building presents a temptation that birds cannot resist. It is astonishing to note how many kinds will come in the spring to gather cotton, straw, horsehair, wool, moss, feathers, or colored yarns laid out for their choice. One experimenter succeeded in persuading several pairs of Baltimore orioles to weave their hanging baskets almost entirely of brilliant-hued knitting yarns.

Birdhouses may be easily built, or they may be bought ready-made. An old wagon wheel on a pole will support an osprey's nest, and a single bracket will give robins and phoebes a place to build. Houses with walls range from simple structures in the form of gourds, hollowed logs, small kegs, and



boxes to the elaborate "apartment houses" intended only for purple martins. Among the birds in various parts of the United States that have been known to nest in birdhouses or sheds of one sort or another are wood ducks, goldeneyes, hooded mergansers, barn owls, screech owls, saw-whet owls, sparrow hawks, six or more species of woodpeckers, two of flycatchers, three of swallows, six of titmice, two of nuthatches, several kinds of wrens and bluebirds, robins, one warbler, and two or more species of finches. The eastern bluebird is especially worth encouraging, because it has perhaps suffered more from the competition of the European starling than any other American hole-nesting bird.

Plans for simple birdhouses are shown on the next page. They need not be works of art, but they should meet definite specifications as to dimensions, size and position of entrance, ventilation, drainage, and the place, height, and date at which they are put up.

More detailed information may be obtained from the National Association of Audubon Societies, 1006 Fifth Avenue, New York City, or found in 'Farmers Bulletin' No. 1456, entitled 'Homes for Birds', sold for five cents by the Superintendent of Documents, Washington, D. C.

Roger T. Peterson's list of things to avoid will also be helpful in building successful birdhouses:

1. Do not make the opening too large.
2. Do not place the hole toward the bottom of the box—except in the case of martin houses. Most birds like to be out of sight while incubating the eggs—so the hole should be well above the center.
3. Do not make two-family or four-family "apartment houses," except for martins. Most songbirds have the "territory" habit highly developed and will not tolerate another family under the same roof.
4. Do not use tin cans. The sun is likely to heat the metal and bake the fledglings.
5. Do not set up too many boxes in a limited area. Except for martins and tree swallows, the normal number of boxes should be not more than three or four to the acre.
6. Do not leave the old nests in the boxes. After each brood, take the box down and clean it.
7. Do not build a birdhouse "for birds"; build it for wrens, for bluebirds, or for some other definite species, keeping in mind the requirements of the desired tenant.

Trees, Shrubs, and Vines

The most satisfactory way of attracting birds of every kind is to "cultivate the range" for their benefit. This means to protect and extend a natural growth of vegetation that furnishes food and shelter. The artificial breeding of game birds is expensive; food dished out by human hands is really useful only as long as the supply never fails. But wonders can be worked by encouraging suitable food plants, keeping wide hedges between tilled fields, and leaving a few dead trunks in the wood lot and a few tangles of undisturbed brush and thicket. A bed of sunflowers left to ripen will keep many birds busy for months. In several parts of the country it has been found that if as little as 2 per cent of the growing grain is left unharvested, this reserve will carry half a dozen coveys of quail through a hard winter.

A fair proportion of trees permitted to grow to full maturity greatly increases the number of birds. Old

woodland, with normal undergrowth and forest-floor plants, is likely to have twice as many kinds of birds and five times as many resident families as young woods of the same sort in which the undergrowth has been cut, burned, or grazed out. The living space of birds is, in other words, to be measured by cubic volume rather than by square area. The British Isles, for instance, have not nearly so many species of birds as occur in most parts of North America. Yet perhaps nowhere else in the Temperate Zone do birds seem to abound as in England. This is due largely to the fact that the English people have wisely preserved so many of their vast and ancient trees.

For planting in places where natural vegetation is lacking, the country is filled with trees, shrubs, and flowers that offer special advantages in the way of shelter, nesting places, and food. Food is not limited to fruits and seeds, but includes also the wide variety of insects associated with certain kinds of plants, such as the gray birch. At least 80 different species of birds are known to eat the fruit of the thicket thorn, and nearly as many patronize some of the mulberries. Native plants are usually to be preferred to foreign species.

Following are the names of a few plants that are regarded as "good" or "excellent" both as nesting sites and as sources of food, together with an indication of the season in which they help the birds' larder. A large proportion of them will thrive in most parts of the United States.

Trees: Flowering dogwood (*Cornus florida*)—autumn; thicket thorn (*Crataegus coccinea*)—autumn and winter; Washington hawthorn (*C. cordata*)—winter; cockspur thorn (*C. crusgalli*)—autumn and winter; red cedar (*Juniperus virginiana*)—winter; crab apples (several species of the genus *Malus*)—winter; white and red mulberries (*Morus alba* and *M. rubra*)—summer; Norway spruce (*Picea excelsa*)—winter; white pine (*Pinus strobus*)—winter.

Shrubs: Alternate-leaved dogwood (*Cornus alternifolia*)—autumn; cornelian cherry (*C. mas*)—autumn; autumn elaeagnus (*Elaeagnus umbellata*)—winter; ground juniper (*Juniperus communis*)—autumn and winter; privet (*Ligustrum vulgare*)—winter; Tartarian honeysuckle (*Lonicera tatarica*)—early summer; bayberry (*Myrica carolinensis*)—autumn and winter; common buckthorn (*Rhamnus cathartica*)—summer and autumn; fragrant sumach (*Rhus canadensis*)—winter; common elder (*Sambucus canadensis*)—autumn; scarlet elder (*S. pubens*)—summer; red-berried elder (*S. racemosa*)—summer and early autumn; arrow-wood (*Viburnum dentatum*)—early autumn; nannyberry (*V. lentago*)—winter; black haw (*V. prunifolium*)—autumn and winter.

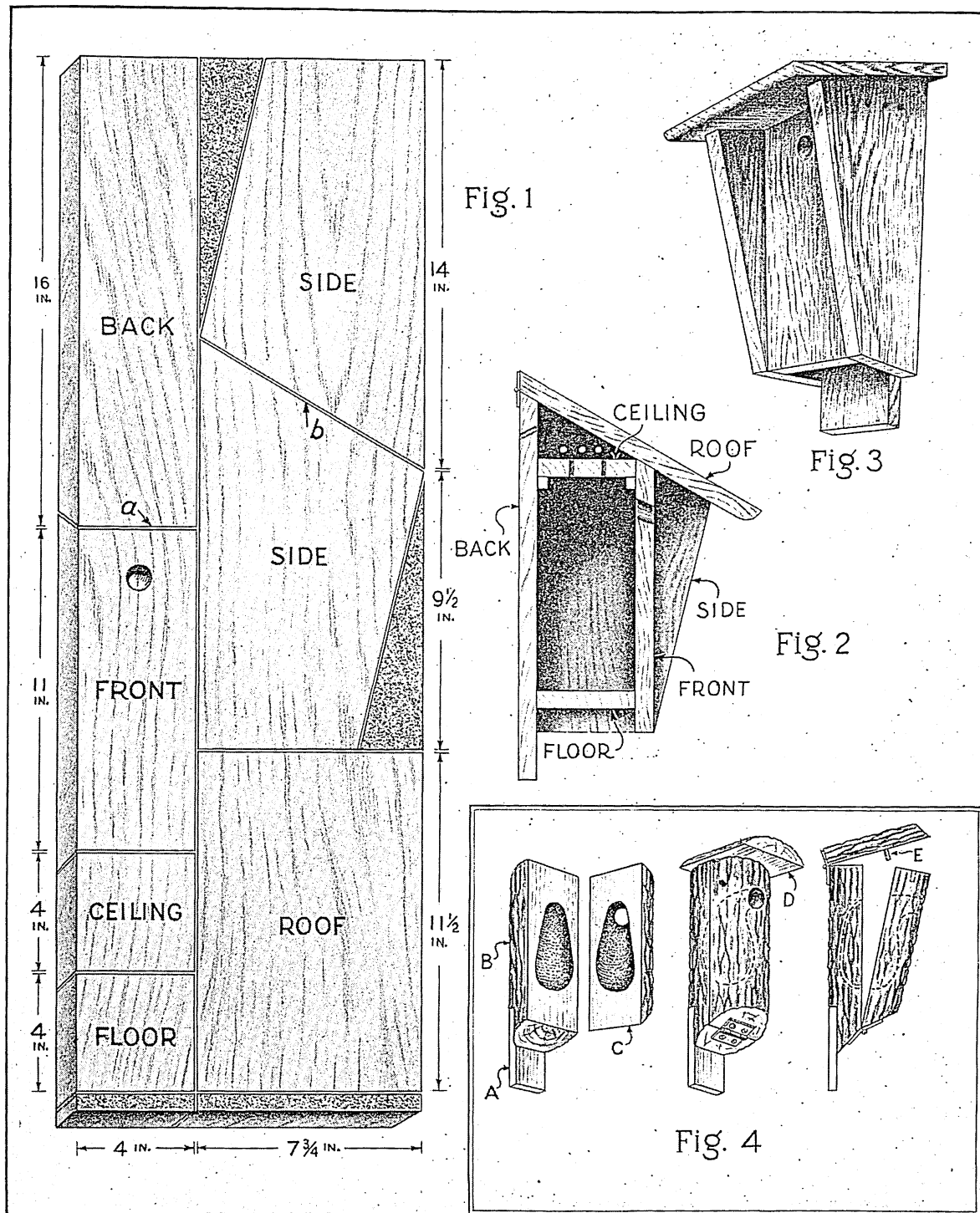
Vines: Virginia creeper (*Pseuderacemata quinquefolia*)—late autumn and winter; common matrimony-vine (*Lycium halimifolium*)—autumn. (See Gardens and Gardening.)

A detailed list of a much larger number of species in relation to birds, as well as to ornamental value and ease and conditions of cultivation, can be purchased for five cents (Circular No. 19) from the National Association of Audubon Societies, 1006 Fifth Ave., New York City.

The Delightful Hobby of Bird Study

The enjoyment and appreciation of birds are sufficient reasons for learning to name them and for encouraging their presence. As Dr. Frank M. Chapman has said, "Birds are nature's most eloquent expression of beauty, joy, and freedom." Bird photography is a

TWO GOOD BIRD HOUSES—EASY TO MAKE



The first of these is designed for wrens. Notice in Fig. 1 that all the parts of this house can be cut out of a single 3-foot board of standard width and thickness (11 1/4 in. by 3/4 in.). The drawings make the design clear. The saw-cut marked *a* in Fig. 1 must be made at an angle of about 60 degrees. The two Sides are identical and the difference between the long edge (14 in.) and the short edge (9 1/2 in.) will make the angle of the saw-cut marked *b* almost exactly 60 degrees. Figs. 2 and 3 show how the parts of the house are assembled. The distance between Ceiling and Floor should be about 8 1/2 in. The Ceiling should not be nailed, but should rest on cleats so that, when the hinged Roof is raised,

the Ceiling can be removed for cleaning out the house. The entrance hole for the wrens must not be more than 3/4 in. in diameter to prevent larger birds from trespassing. It should slope upward so rain will not run in. The ventilating holes around the top and through the Ceiling will help to keep the house cool in hot weather. Painting the house inside and out will make it last longer. Fig. 4 shows another type of house for wrens, bluebirds, or flickers, easily made by splitting and hollowing out a small log. The board A is used to fasten the house to a post or limb. B and C are hinged at the bottom; and the roof D holds the two together at the top by means of the short pin E.

delightful and rewarding hobby, though it requires ingenuity. To get good bird pictures, one must generally use "blinds," such as a draped beach umbrella, or a screen of vegetation, or one may use long cable releases or strings for snapping the camera shutter from a distance. Though relatively few persons can take up bird study as a serious avocation, those who are keenly interested can find abundant opportunity to add to the sum of knowledge.

The time has passed in which collecting skins, eggs, or nests can accomplish anything of importance except in connection with special and unusual problems. North American birds are nearly all well known as to description and range, and adequate collections are preserved in museums. It is the living bird that now offers the most helpful opportunity for real research. The motto of *Bird-Lore* well states the fact: "A bird in the bush is worth two in the hand!"

Exactness and objectiveness in making notes are more important than "fine writing." The great poets and naturalists of our own and earlier generations have given us a rich record of the impressions made by birds upon sensitive human beings; but scientific understanding of the basis of bird behavior has lagged behind. It is easy, but not very helpful, to "humanize" birds. They are highly instinctive creatures, with marvelous sense organs and bodily processes that proceed at a high rate. Their pulse and respiration are more rapid than ours and their temperature considerably higher. On the other hand, their brains have none of the folded surface and very little of the "gray matter" that characterize the brain of a man or even of a dog. The mental processes of birds, indeed, are in some respects more closely akin to those of insects than of mammals.

How do birds respond in recognizing their own kind or other species, and in their courtship? What is the

true meaning of their singing? Why their exclusiveness and jealousy regarding the private "territory" of breeding pairs? How does the internal "clockwork" of their bodies make them migrate at one season, build nests of a constant type at another, sit on eggs later, rear and then "heartlessly" abandon or drive away their fledglings? When we study such problems carefully, we soon realize that we are entering a field in which only precise, and, if possible, statistical information is of service.

Bird Banding

A development of recent years that has added greatly to exact knowledge of birds is the well-organized custom of bird banding. To undertake this, one must first be able to identify one's captives with certainty and be well acquainted with right and wrong methods, learned from the experience of bird banders in the United States and Europe. A permit to trap and band must be obtained from the Fish and Wildlife Service at Washington. This service also supplies numbered aluminum leg bands and full instructions regarding cage traps, other equipment, and technique.

Hundreds of thousands of birds are now banded annually in the United States. A fair proportion of this work is undertaken or shared in by young people. The returns are surprisingly high, and a great deal has been learned about the routes and length of migration, the "homing" propensities of birds, the age to which they live, and their relationship to individual mates. Banding and trapping enable an observer to *know*, instead of merely to guess, that the phoebe nesting on his porch was there last year. Moreover, many birds, such as the house wren, will stand almost any amount of proper handling, and so it is possible by catching them in their birdhouses to band all the residents of such species in an entire district and follow their complicated family relationships from brood to brood and year to year. (See also Nature Study.)

A HOME-MADE FOOD HOPPER



A pailful of sunflower seeds, ground raw peanuts, hemp, and millet will save many birds when snow and ice cover up natural foods.

Protecting and Conserving Our Birds

Interest in birds and their conservation no longer requires any justification. It is hardly necessary even to point out the economic importance of birds because of the insects they eat. Indeed, this particular value has been overemphasized. Many more kinds of insects are beneficial than are harmful, and birds seldom discriminate. But insects multiply at an incredible rate, and even "useful" forms become a pest when they grow overabundant. The essential place of birds in nature's long chain of the eaters and the eaten is to do their part in keeping the delicate balance. The only birds that do not fit well in the balance

are the foreign introductions, like English sparrows and starlings; but this is true also of other forms of life that have been brought from abroad, such as house cats, carp, the Japanese beetle, the gypsy moth, many European weeds, and Old World organisms that cause plant diseases.

When North America was a wilderness, native animal life of every sort was amazingly abundant. It was controlled directly by climate rather than by changes brought about by man in cutting down forests and adapting the land to crops, to pasture for cattle, and to sites for villages and cities.

Brooks and larger streams ran with clear water in which trout, food plants, and countless other forms of life could thrive. There was no pollution from sewage or factories. The watersheds were protected by dense growths of grass, shrubs, trees, and forest litter. The "water table" in the ground was held at a high level by dams of the beaver, which lived nearly everywhere from Mexico to the edge of the Arctic. Thus the clean streams were constantly checked on their way toward the sea, and water was made to yield its fullest use to enrich the vegetation upon which all animal life depends.

It was only after man had recklessly felled the trees on the steep hillsides and had plowed the land in a way permitting rainfall to form gullies and wash away the topsoil, that many rivers turned brown or red with "the lifeblood of the land." The amount of plant food in this soil now wastefully carried to the ocean by rivers in the United States is reckoned to be 20 times as much as the amount taken from the soil by all farm crops.

Predatory Animals and the Balance of Nature

It should be noted that in primitive times the predatory animals—those that eat others, such as wolves, mountain lions, lynxes, weasels, eagles, hawks, and owls—existed in far greater number than in our own time. Yet, in spite of this, the plant eaters, the creatures we call game, the songbirds, and all other harmless and familiar animals flourished. Probably no wild bird or beast under natural conditions has ever exterminated another species or even seriously reduced its numbers. The flesh eater varies its diet; it kills off the weak and the sick in greater proportion than the strong; also, its food usually includes other enemies of the species upon which it relies for its living.

Seldom, indeed, can man determine which wild animals are beneficial and which are destructive or undesirable, because the chains of relationship in nature are mostly complex and hidden from our view (see Ecology). An example may illustrate this. In Georgia, where quail are fostered as game birds, it was formerly the custom of sportsmen to shoot marsh hawks at every opportunity because these hawks sometimes killed quail. But the slaughter of marsh hawks seemed to accomplish nothing toward in-

creasing the numbers of quail. Finally it was learned from the examination of stomach contents that the marsh hawk feeds mainly upon the cotton rat, a rodent highly destructive to the eggs of quail and other ground-nesting birds. By being a much greater foe of cotton rats than of quail, the marsh hawk proves actually to be a *friend* of the quail. The killing of this bird of prey has now largely ceased in Georgia, and both marsh hawks and quail are growing more numerous side by side.

Again, it is well known that anglers are likely to have a strong prejudice against fish-eating birds, such as pelicans, cormorants, kingfishers, herons, terns, ospreys, and certain ducks. Careful studies show, however, that these birds have little to do with the decline in fishing, because their prey is made up largely of non-game fishes, including kinds that eat the spawn or young fry of others.

Many similar examples might be given to prove that predatory animals are an essential part of what is called "balanced nature" and that most of the antagonism toward them is due to lack of sound knowledge.

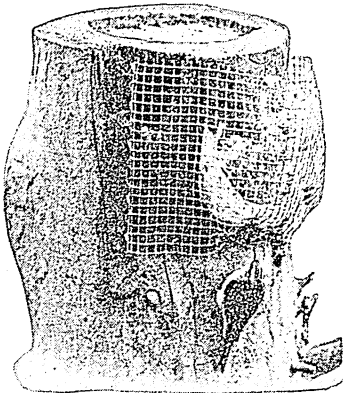
Indians and the Balance of Nature

The Indians too, who occupied this continent before white men arrived, were merely a part of the great balance of nature and did not seriously affect it, as the white man did later. Most of the Indians were flesh eaters, who ate game of many kinds. But their population was relatively small, their weapons not unduly deadly, and their motive was to gain necessary food and clothing rather than to satisfy a love of sport. The red men performed no engineering or agricultural feats to alter the face of nature on a grand scale. Moreover, they observed the principles of conservation better than their white successors, because whenever game was temporarily reduced by excessive killing or by natural causes, there was room to change the hunting grounds. They lived in the midst of teeming wild life that might have continued indefinitely.

Misuse of Resources

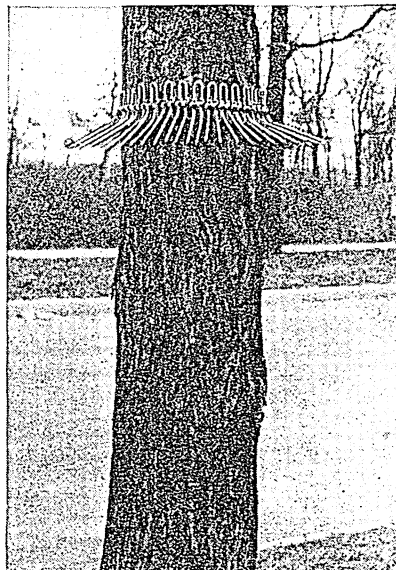
Now no one would wish the whole course of history changed, or the civilization that has followed the Indians to be wiped out, for the sake of restoring the primitive state of nature. Nevertheless, if that civilization is to go forward,

WIRE FOOD PROTECTOR



Wire screening fastened in this way serves to hold either food or nesting material. The cage shown here contains suet. It is protected from crows and squirrels, but the little brown creeper has no trouble in getting at it.

THIS STOPS THE CATS



With a simple bent-wire device like this around a tree in which there are nests, your bird neighbors are safe from cats and other climbing enemies.

we shall have to take account of the widespread and unnecessary destruction resulting from ignorance, heedlessness, or selfishness. It is safe to say that North America in the last three centuries has suffered more from misuse of natural resources than any other continent.

We must realize that it is not possible to save our birds alone, or the forests, the wild flowers, the life of river and sea, the game mammals, the fur bearers, or anything else alone, because nature is a great unit. Every evil practise with regard to one aspect spreads out through the web of life and affects many others. The goal must be to restore and maintain the closest approach to balanced nature that is consistent with the requirements of a large human population.

The "Inexhaustible" Game Supply of Early Days

Writings of the early European colonists in North America are filled with expressions of wonder at the wealth of life. This applied to the variety of trees in the forest (eight times as many as in Europe), to the fruit and flowers, the squirrels and deer, the fish, the lobsters and oysters, and perhaps most of all to the birds. It was natural that every toothsome wild fowl should have been considered a God-given resource, especially by Englishmen who came from a country where a man might be imprisoned for taking a pheasant's egg, or hanged for killing the deer of a

rapid increase, and that the change men were making in the character of the country was depriving most birds and other wild animals of food and cover at the same time that they were being killed by every means and at every season.

Birds That Have Vanished or Dwindled

The wild turkey, which lived only in North America, was one of the first birds to become greatly reduced. The reason is simple, for a visitor to New Jersey in the year 1648 mentions a flock of 500 turkeys "got by nets" at one time! This wonderful fowl was fortunately not altogether disappeared, and is today even gaining in certain states. It is important to recall, however, that the settlers in New England and the Middle Atlantic states quickly wiped out the wild turkeys along the Atlantic seaboard. Domestic turkeys, the descendants of birds that had been carried from America to Europe by Spaniards, were brought back across the Atlantic to New England and New York at about the time when the last local wild turkeys disappeared. It is worth noting here that the Spanish colonists were much more clever than the British in domesticating and cultivating all sorts of useful animals and plants of the New World.

Other splendid birds that have fared even worse than the turkey are the Carolina parakeet, the heath hen, or eastern prairie chicken, and the passenger pigeon. These were extremely abundant, but the last

survivor of each has perished since the beginning of the present century.

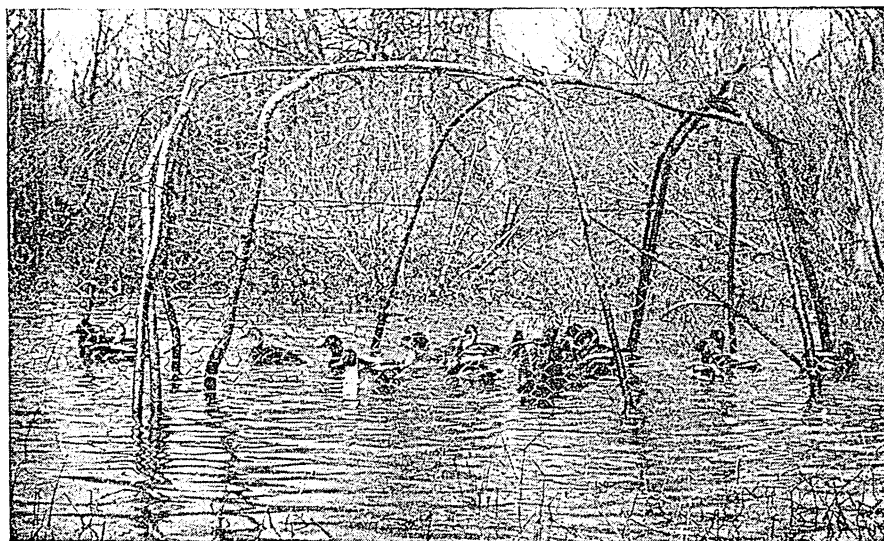
The passenger pigeon used to travel in flocks that darkened the sky and took hours or days to pass a given point. It fed especially upon the nuts of the beech and the acorns of the white oak, and the old-time groves of these immense trees also furnished its nesting places. Passenger pigeons became such "common" food that servants and even slaves objected to eating them. Men laughed at the idea that the wild pigeons might ever become "scarce." Yet Audubon, the great naturalist, appears to have foreseen that the endless slaughter,

combined with the cutting down of the oak forests, could not fail to be disastrous. At any rate, the last passenger pigeon died in the zoo at Cincinnati in 1914. (See also Pigeons and Doves.)

Can These Birds Be Saved?

Among remarkable North American birds that have dwindled to great rarity because of less direct and

HEART-SHAPED TRAP CATCHES DUCKS FOR BANDING



Though the camera hardly shows it, these mallards and pintails are securely trapped in a cage of wire netting. The netting covers the framework of poles and is arranged on one side to form a long funnel leading inward and ending in a small opening. Once the birds have entered through this opening, they rarely find their way out again.

landed proprietor. It was a welcome change to feel that wild turkeys, heath hens, partridges, pigeons, ducks, geese, swans, cranes, rails, and many smaller birds might be taken in this New World, freely and without limit. Game was regarded as "inexhaustible."

The sad error lay in the fact that for the first time in America mankind was undergoing an amazingly

THE TRUMPETER SWAN, ONE OF THE RAREST OF AMERICAN BIRDS



These beautiful white birds that once spread their wings over all North America are now reduced to a handful in the Red Rock Lakes Migratory Waterfowl Refuge in Montana and near-by Yellowstone Park. Under rigid protection, their number is slowly increasing.

possibly less wanton persecution are the ivory-billed woodpecker, the California condor, the whooping crane, and the trumpeter swan. The first of these is the "king of woodpeckers," larger than a crow, black and white and crested with scarlet, armed with a white beak and equipped with the most remarkable adaptations known in the woodpecker family. The enormous chips it hews from trees infested with wood-boring insects have been likened to the work of a corps of axmen. Its existence depends upon stands of gigantic cypresses and similar trees and, unlike many birds, it does not tolerate the close presence of man. Following the clean sweep of the southern forests by lumbermen, it has all but vanished. This illustrates once again that we cannot abuse one aspect of life without at the same time working unexpected damage upon others.

The whooping crane and the trumpeter swan have likewise suffered, in part because of damage to their ranges. The case of the California condor, largest of North American birds, is less clear. The condor is a harmless carrion eater of limited distribution, and its disappearance has to some extent been due to poisoned carcasses set for bears and coyotes. The thoughtless man with a rifle, ever ready to prove his marksmanship on a living target, probably is also to blame. Efforts are now being made to save the few remaining condors.

Certain marine birds were exterminated at an early date for the reason that their breeding grounds were limited to small localities. Thus the great auk, a flightless swimmer bearing some resemblance to the penguin, nested only on a few northerly islets in the North Atlantic. About 1844 the last bird disappeared forever because of the constant raids made by sailors during the egg-laying season. The Labrador duck died out somewhat later. It appears to be always true that when an animal population becomes reduced below a wide margin of safety the species is sure to go.

Conserving Our Waterfowl

In general, the North American waterfowl, such as wild ducks of many kinds, for a long while held their own better than the birds thus far named. This was because they came chiefly as autumn migrants from nesting grounds in the extensive marshy wilderness of the Northwest. They could thus for a time withstand even the heavy toll of market-hunting, in the course of which a single professional gunner might bag several thousand ducks in one season. They were at least able to rear large broods after they had returned to their summer homes, and thus restore a good proportion of the annual loss.

But matters took a rapid turn for the worse with the sowing of the Northwestern states and the Canadian Prairie Provinces to grain, the steady growth

of population and consequently of hunters, the modernization of arms and ammunition, the extension of roads, and the coming of motor cars. Only shortening of the shooting season, lowering the bag limit, outlawing the sale of game, and the establishment of refuges or sanctuaries have saved these game birds from final destruction. Their condition today is by no means as secure as we must still make it if we hope to preserve them for the enjoyment of future generations.

The effect of breechloaders and smokeless powder was especially marked upon the shore birds, that is, the many species of snipes and plovers. These were shot with old-fashioned firearms throughout most of the historic period, but after rapid-fire shotguns came into use, they were suddenly almost wiped out of existence. One of them, the Eskimo curlew, is probably extinct, and several others are in grave danger. The permanent protection now given in the United States and Canada to all but two kinds, the woodcock and Wilson's snipe, has shown encouraging results.

It is not improper to regard game as a "crop" and shooting as a reasonable recreation. The point to remember is that the continuance of game, rather than the choice of those who like to shoot, must always be the basis of legal control. Since some birds, such as many ducks and members of the grouse family, are widely distributed and relatively resourceful, they can support well-regulated shooting both now and in the future. Others, such as most shore birds, can probably never stand any shooting at all under modern conditions.

The Dangers of Artificial Drainage

Ducks and innumerable other marsh-living birds all over the United States have suffered severely from the artificial drainage of wet or moist areas. The public attitude in this matter seems to be almost peculiar to America, because in the Old World ponds and marshes are traditionally considered places of beauty, worthy of being saved for their reserves of wild flowers, reeds and cat-tails, fish, birds, and other forms of life that can thrive nowhere else. Among us, most of the natural ponds in thickly settled regions have been filled with ashes and defunct motor cars, while hundreds of millions of dollars have been spent in draining the marshy homes of waterfowl, without any equivalent success in making new tracts available for agriculture. The water table has been lowered, to the detriment of the surrounding country; alkaline wastes have remained on the sites, as at Malheur and Klamath lakes in Oregon and northern California; or the humus has dried and burned down to the limestone, as over much of the Florida Everglades.

Drainage is sometimes justifiable, or even necessary, but when it results from political activity, and is carried out by engineers without benefit of biological advice, its effects are almost certain to be unfortunate. A large part of the so-called mosquito drainage has failed of its purpose, while at the same

time a desirable balance of life on the marshes has been disastrously upset.

Hunting Plumes and Trapping Songbirds

Certain other practices that endangered many kinds of birds have been banned forever. One of these is "plume hunting" for feathers to use on women's hats. Fifty or sixty years ago this barbarous custom had a wide vogue and was responsible for an appalling slaughter of egrets and other herons, gulls, grebes, and many songbirds. W. E. D. Scott writes in his 'Story of a Bird Lover' that when he worked in a New York taxidermist's shop in 1874, from 350 to 400 songbirds were purchased *daily* from local gunners. The long and finally triumphant fight against millinery traffic in birds was a turning point in American wildlife protection. Only in recent years have some of the most severely persecuted species begun to regain their numbers and reoccupy their old ranges.

Another custom that seems strange to us today was the commerce in trapping songbirds. Few can now appreciate the effect of this on the bird life of large areas. About 1880, when caged mocking-birds, cardinals, and scores of other species were in demand, one of many bird dealers in New York City received and sold 800 male bobolinks. Small wonder that this cheerful songster no longer inhabits the Long Island fields where it once abounded!

Beginnings of Legal Protection

White men had been multiplying a long while in the American colonies before there was any broad attempt to stop unlimited killing of birds or other game. The colonists were a free people, accustomed to dealing as they pleased with the "inexhaustible" riches of the new country, and they resented interference as bitterly as many gunners of a later day objected to the ending of the spring shooting season for ducks.

The first legal control of any kind was adopted in the Dutch colony of New Netherlands in 1629. In 1677 Connecticut, and in 1694 Massachusetts, followed with laws establishing a closed season for certain game. North Carolina, the first Southern colony to act, began the partial protection of game in 1738. In 1818 Massachusetts made it unlawful to kill robins between March 1 and July 4!

By the end of the Colonial period, 12 of the original colonies had at least a few game laws. However, it was not until 1878—a mere two generations ago—that Iowa became the first state to fix a bag limit by restricting the number of grouse and prairie chickens that might be killed by a single hunter during one day and one season. The Latin American colonists were more advanced than our own ancestors, for sensible game statutes, reading not unlike those with which we are familiar today, were decreed at Lima, Peru, as early as the year 1555.

Rise of the Conservation Movement

Nevertheless, in course of time North Americans took the lead (*see* Conservation). It was through the liberty-loving people of our own youthful republic, as Dr. T. Gilbert Pearson has written . . . "that

there was to take form a new policy in Anglo-Saxon jurisprudence with reference to man's legal relationship to wild life. It was their legislatures that in time declared that the living wild game of the state belongs to the whole people of the state, with the legislature holding it in trust, and that no wild bird or other animal belongs to an individual man until

high standard for societies which coöperate with other private agencies and with the state and federal governments.

The United States Biological Survey came into being in 1905, growing out of an office of economic ornithology in the Department of Agriculture. In 1940 it was combined with the Bureau of Fisheries as

RESTORING A NESTING AND FEEDING AREA FOR WATERFOWL



By restoring marshes, such as this one in the Upper Souris Refuge, N. D., waterfowl are persuaded to return to their old homes. CCC workers are building a wave breaker and nesting islands.

it has first been reduced to possession. Furthermore, it was the courts they established that upheld the validity of these statutes. And based upon these principles there was founded the unique and daring American experiment of attempting to preserve a nation's game supply and at the same time provide a reasonable amount for limitless . . . hunters."

Probably 95 per cent of our bird protective laws have been enacted within the past 50 years. Yet before the middle of the 19th century enough public sentiment had developed so that considerable support was working toward needed legislation. By 1883, when the American Ornithologists' Union was founded, 19 of the 39 states then existing afforded protection of some sort to non-game birds. The Ornithologists' Union was active in stimulating laws for the protection of birds "not used for food," but for many years law-enforcement officers were woefully few.

Audubon Societies and the Biological Survey

The first Audubon Society was formed in New York in 1886, the beginning of a movement that soon became influential. In 1905 the National Association of Audubon Societies was incorporated. This association has since been active on every front. It has conducted educational campaigns and legislative battles, and has enrolled thousands of men and women and millions of school children. It publishes the magazine *Bird-Lore* and much other literature relating to birds, maintains sanctuaries for oppressed species or as symbols of what can be accomplished, and operates a summer camp in which teachers and other leaders are trained. Through these and other activities the National Association of Audubon Societies has set a

the Fish and Wildlife Service in the Department of the Interior. It has become the chief federal fact-finding and operating agency in its field. Its work is conducted by a highly trained scientific staff. It administers the treaty obligations of the United States with reference to migratory birds. It selects, acquires, maintains, and guards the government's bird refuges. It issues the permits to import, trap, and band birds, or to collect specimens for scientific purposes. The publications

of the Biological Survey, many of which are distributed free or at trifling cost, have been a great factor in educating the American public about the value of birds.

Other Protective Agencies

Other organizations concerned with bird protection, or with sound policies on natural resources which include birds, are too numerous to list. Some of the national groups are the General Wildlife Federation, the American Nature Association, and the Izaak Walton League of America. Nor can we neglect to mention the powerful activities of the national federations of women's clubs and garden clubs, and the broad and fruitful interest in conservation that has grown up among such young peoples' organizations as the Boy Scouts, the Girl Scouts, the Campfire Girls, and the 4-H Clubs.

Every state in the Union now has a department devoted to the conservation of wild life. In the main, the growth of good laws has been gradual, as indicated above, but there have been periods of monumental advances, such as the passage by Congress of the Migratory Bird Treaty Act on July 3, 1918, and the establishment of extensive national bird refuges, which began in 1924.

The treaty referred to was a formal agreement between the United States and Great Britain for the protection of migratory birds in the United States and Canada. At the same time the Model Law, generally known as the "Audubon Law," which was already in force in most states, was followed in the naming of about 250 species and subspecies of birds as game. More than half of these, however, including nearly all

the shore birds, were put under complete protection for a term of years which was later extended. In 1936 a similar treaty, though with less comprehensive provisions, was negotiated with Mexico. The Migratory Bird Conservation Act of Feb. 18, 1929, provides for the acquisition of lands suitable as feeding, resting, and breeding grounds for migratory birds. The Tariff Act of 1930 forbids the importation of birds and bird products protected by foreign countries.

Refuges and Sanctuaries

It has long been recognized that refuges and sanctuaries, in which no shooting is permitted at any time, are needed as resting places for game birds. Moreover, with the constantly increasing use of the land for lumbering, grazing, agriculture, or settlement, it becomes a pressing necessity to set aside portions as "wilderness areas" in which all wild life may work out its natural balance under the closest approach to undisturbed conditions. Some sanctuaries are therefore intended for the protection of particular species, others for the welfare of many.

The first United States Government bird reservation was that created at Pelican Island, Fla., by executive order of President Theodore Roosevelt, on March 14, 1903. This great leader in conservation signed 50 later orders to accomplish similar purposes, and every president since his time has added to the list. Other federal reservations have been set aside by Congress, and the movement has grown rapidly during the last few years. The Fish and Wildlife Service now administers some 250 refuges for birds and 13 big-game reserves on which birds also are protected. These have a total area of nearly 14 million acres.

Most of the bird refuges are west of the Mississippi, although the Gulf Coast and the Atlantic Coast from New Jersey southward are well covered. There are refuges in nearly every Western state. North Dakota alone has about 75, some of which have been leased at a nominal rate by the government instead of being purchased. There are federal refuges also in Alaska, Hawaii, and Puerto Rico.

The sanctuary policy of the National Association of Audubon Societies concentrates on the protection of threatened species of birds rather than on maintaining areas for other kinds. The largest sanctuary owned by the association is the Rainey Sanctuary on the coastal marshes of Louisiana, where thousands of ducks and geese pass the winter. Colonies of breeding herons, egrets, spoonbills, and pelicans, as well as other birds with too many human enemies, are guarded from Florida and Texas to New England. Some of the smaller sites change from year to year, as the birds shift their headquarters, but the number of sanctuaries administered is usually about 45.

The National Association also maintains the Roosevelt Sanctuary, at Oyster Bay, Long Island. In this sanctuary of 13 acres, 140 species of birds have been observed, and by scientific planting and protection the number and variety of nesting birds have been greatly increased. Such a demonstration saves no

species from extinction, but its educational value is great because the thousands of visitors can see the result of wise methods.

If we add to all such protected lands the sanctuaries maintained by many local societies all over the United States, we find that the wild-life refuges of our country today have a total area equal to at least ten times the size of the six New England states. (See also Conservation.)

Some Books About Birds

Below are lists of bird books that are particularly recommended. The second part is a choice of ten books for adults, or mature younger readers, made by the staff of the National Association of Audubon Societies.

—Books for Younger Readers:

- Allen, A. A. *American Bird Biographies* (Comstock, 1939).
- Allen, A. A. *The Golden Plover and Other Birds* (Comstock, 1939).
- Boulton, W. R. *Traveling with the Birds* (Donohue, 1933).
- Burgess, T. W. *The Burgess Bird Book for Children* (Little, 1919).
- Chapman, F. M. *The Travels of Birds* (Appleton-Century, 1916).
- Chapman, F. M. *What Bird Is That?* (Appleton-Century, 1920).
- King, Julius. *Birds*, 3v. (Harter, 1934).
- Peterson, R. T. *The Junior Book of Birds* (Houghton, 1939).

—Books for Advanced Students and Teachers:

- Allen, G. M. *Birds and Their Attributes* (Marshall Jones Co., 1925).
- Bailey, Mrs. F. A. *Handbook of Birds of the Western United States* (Houghton, 1927).
- Chapman, F. M. *Handbook of Birds of Eastern North America* (Appleton-Century, 1937).
- Herrick, F. H. *Wild Birds at Home* (Appleton-Century, 1935).
- Hoffmann, Ralph. *Birds of the Pacific States* (Houghton, 1938).
- National Geographic Society. *The Book of Birds*, 2v. (1937).
- Nicholson, E. M. *How Birds Live* (Williams and Norgate, 1929).
- Peterson, R. T. *A Field Guide to the Birds* (Houghton, 1939).
- Priestly, M. C., ed. *A Book of Birds* (Macmillan, 1938).
- Thomson, A. L. *Bird Migration* (Witherby, 1936).

—State Bird Books:

- Bailey, Mrs. F. A. *Birds of New Mexico* (N. M. Dept. of Game and Fish, 1928).
- Dawson, W. L. *The Birds of California*, 4v. (South Moulton Co., 1923).
- Eaton, E. H. *The Birds of New York*, 2v. (N. Y. State Museum, 1910-14).
- Forbush, E. H. *Birds of Massachusetts and Other New England States*, 3v. (Mass. Sec'y of State, 1929).
- Howell, A. H. *Florida Bird Life* (Fla. Dept. of Game and Fresh Water Fish, 1932).
- Roberts, T. S. *The Birds of Minnesota* (Univ. of Minn. Press, 1936). [Students who cannot afford this set will find useful 'Bird Portraits in Color', a collection of all the color plates with a page of general text for each plate.]
- Stone, Witmer. *Bird Studies at Old Cape May* (New Jersey) (Academy of Natural Sciences, 1937).
- Taverner, P. A. *Birds of Canada* (McKay, 1938).

Note.—The books in the third part of this list will be found useful for neighboring states as well as for the special states they cover. Some of them are too expensive for the average reader to buy and will have to be consulted in libraries. The Superintendent of Documents, Washington, D. C., will send free price lists of government publications relating to birds. Information about state publications may be obtained from the various state agricultural colleges, from state departments of conservation, and from museums.

BIRMINGHAM, ALA. One of the most striking examples of the industrial development of the new South is the growth of Birmingham. Within two generations, from a little town of 3,000 inhabitants, it has grown to be "the Pittsburgh of the South" and one of the leading centers of the iron and coal industry in the country.

The city itself is built partly on the slope of Red Mountain, so named from its outcrop of red hema-

tite iron ore. For many miles this iron ore extends in every direction from the city, in a vein from 6 to 26 feet thick and of indefinite depth. Birmingham is also the heart of the coal and limestone district of the South. Everything necessary for an almost unlimited production of steel at the lowest cost is, therefore, right at hand, and these conditions are building up a great city with a rapidity almost unparalleled.

Though Birmingham's prosperity is based on its enormous iron and steel plants, it has become a center for diversified manufactures. It leads the country in the making of cast iron pipe, and has great rolling and steel-plate mills, stove foundries, and structural steel works. It also makes machinery of many kinds, brick and clay products, cement, and cotton seed products. As by-products of its huge coke industry it turns out a great variety of chemicals. Meat packing and corn milling are also important. It is one of the country's leading lumber markets, shipping thousands of carloads of yellow pine every year.

Another factor in Birmingham's prosperity is its excellent transportation. It is served by several railroads, and is near the terminus of a water route to the Gulf of Mexico by way of the Black Warrior, Tombigbee, and Mobile rivers. Hydroelectric plants on the nearby rivers provide cheap and abundant power.

Birmingham has many public parks and a fine school system, with two co-educational colleges, Birmingham-Southern and Howard. It is governed by a board of three commissioners and is the hub of a metropolitan area with some 350,000 population. The city was founded in 1871 after the discovery of coal, iron, and limestone deposits. It was named after Birmingham, the English industrial city. Population (1940 census), 267,583.

BIRMINGHAM, ENGLAND. In almost the center of England, 113 miles northwest of London, lies Birmingham, one of the greatest metal-manufacturing cities in the world, and the metropolis of England's industrial Midlands area. The town existed before the Norman Conquest and its manufactures date at least from the early 16th century. It was not until 1832, however, that Birmingham was given parliamentary representation, after one of the fiercest battles in the administrative reforms of that period. Its university, created in 1898, is one of the largest in the United Kingdom.

Toward the close of the 17th century Birmingham had gained wide importance as a manufacturing city, due in large part to the extensive coal and iron beds with which it is surrounded. The leading industry today of the district of which Birmingham is the center is metal-working of all sorts—foundry, rolling, stamping, plating, drawing, etc.—and the products include machinery, engines, iron roofs, girders, and all sorts of industrial wares. The manufacture of railway carriages is an extensive industry, and Birmingham is one of Great Britain's chief centers for

the manufacture of automobiles, tires, and accessories. Other products are electrical apparatus, chemicals, brass goods, steel pens, screws and nails, buttons, pins, hooks and eyes, gold and silver articles, and firearms. In wartime, Birmingham produces huge quantities of munitions, and so it was fiercely bombed by the German air force during the second World War. Large areas were wholly destroyed. Among the many industrial communities that surround Birmingham is Soho, where James Watt perfected his steam engine. Population, more than 1,000,000.

BISMARCK, OTTO VON (1815-1898). Three men sat about a table in the house of the imperial chancellor in Berlin. Although the table was filled with good things to eat, the men made little pretense at eating, for they were all nervously awaiting a dispatch from their king, William I of Prussia, who was at Ems. The French ambassador had sought an interview with him there and on its outcome might hang the issue of peace or war.

Presently a servant entered bearing the looked-for message. He handed it to Bismarck, the master of the house, who read it to his two guests—General von Moltke, the chief of the Prussian army staff, and General von Roon, the minister of war.

In telling of the incident afterwards, Bismarck said: "As I read the dispatch to them, they were both actually terrified, and Moltke's whole being suddenly changed. He seemed to be quite old and infirm. It looked as if our most gracious majesty might knuckle under after all. I asked him (Moltke) if, as things stood, we might hope to be victorious. On his replying in the affirmative, I said, 'Wait a minute,' and seating myself at a small table, I boiled down those 200 words to about 20, but without otherwise altering or adding anything. It was the same telegram, yet something different—shorter, more determined, less dubious. Then I handed it over to them, and asked, 'Well, how does that do now?' 'Yes,' they said, 'it will do in that form!' And Moltke immediately became quite young and fresh again. He had got his war, his trade."

France Tricked into War

The dispatch, thus altered, was interpreted in the press to mean that the king had been insulted and had snubbed the French envoy—which was not the case. In both Berlin and Paris the war spirit rose to fever heat, and on July 19, 1870, France declared war. Thus by trickery Bismarck, with his policy of "blood and iron" and his disbelief in democracy and "speeches and majority votes," became the real founder of that German Empire which again plunged the world into war in 1914.

By birth and tradition Bismarck was a member of the conservative German "Junkers" or landed aristocracy. At school he had spent more time in fighting than in studying, and when he lived on his estate his neighbors called him the "crazy" Bismarck because of his reckless actions. But all this changed when he began his long public career.

He once said: "From the beginning of my career, I have had but one guiding star: by what means and in what way can I bring Germany to unity." He early saw that Austria was the real obstacle in Prussia's way, and so he set about humiliating her. When he first entered the Frankfort Diet as the representative of the king of Prussia, only the Austrian representative smoked. Bismarck, wishing to show the importance of his own country, immediately began to smoke. At first the delegates from the other German states were horrified, but they soon followed his example, and Austria lost this mark of superiority.

Building Up the War Machine

Bismarck recognized that Prussia must become a great military power if it would defeat Austria. So he set to work to secure a reorganization of the Prussian army. To accomplish this, for four years he was obliged to wage an unceasing conflict with the Prussian legislature, which refused to vote the necessary funds. His first chance to use his reorganized army came in 1864. In that year a war was successfully waged by Austria and Prussia against Denmark for the possession of the two little provinces of Schleswig and Holstein. As a result of the war the duchies came temporarily under the control of the victors. Then Bismarck unscrupulously picked a quarrel with Austria over the management of the spoils. Within seven weeks Austria was completely defeated and Prussia stood forth the all-powerful leader of Germany.

Although Austria was given a liberal peace, she was forced to consent to a reorganization of Germany in which she was not included. For a time this new organization took the form of a North German Confederation. When Bismarck tricked France into declaring war, as described above, the South German states joined Prussia, and after one of the most humiliating wars in her history France saw the victorious German troops march through the streets of her capital. On Jan. 18, 1871, Bismarck's goal was won with the proclamation of the new German Empire in the French royal palace at Versailles.

For 20 years Bismarck continued to govern the country he had made. He built up its manufactures and its trade until Germany was the leading country on the continent. But when the young William II came to the throne of Germany, he wished actually to rule instead of leaving affairs in the hands of Bismarck. So the old pilot, who had guided the ship of state for so many years, was deposed from power, and the remaining eight years of his life were spent, like Achilles, in sulking in private and in writing the memoirs of his official life.

Bismarck's full name was Otto Eduard Leopold von Bismarck-Schönhausen. He was made count after the Danish War, and a prince after the war with France. The third volume of his memoirs, because of its damaging reflections on Emperor William II, was suppressed until after the revolution which made Germany a republic. Bismarck's published volume of letters to his wife gives us a picture of him as a man warmly devoted to his family.

BISMUTH. Unlike most other metals, which are used chiefly in making industrial products, the metal called bismuth is used chiefly in making medicines. It is one of our important defenses against illness.

Certain salts of bismuth are used in indigestion remedies to soothe irritated mucous membranes; others are injected into the blood stream to kill germs. Salves, ointments, and healing powders also contain compounds of bismuth. Its salts were formerly fed to patients for most X-ray examinations of the digestive tract, because in the photograph these salts clearly outline the intestines and stomach. Today the less soluble barium sulphate is more generally used.

Various alloys of bismuth serve as safety plugs in automatic fire sprinklers. Pure bismuth does not melt below 520° F., but its alloys with lead, tin, and cadmium melt at below the boiling point of water (see Alloys). When a fire starts, the heat quickly melts the safety plugs, which release water from ceiling nozzles. Boilers have similar plugs to prevent explosions due to overheating.

Like antimony, bismuth expands when passing from the melted to the solid state. Because it does not shrink when hardening, its alloys are used for making molds and molded objects, notably dental models. It is also used for plastics and optical glass.

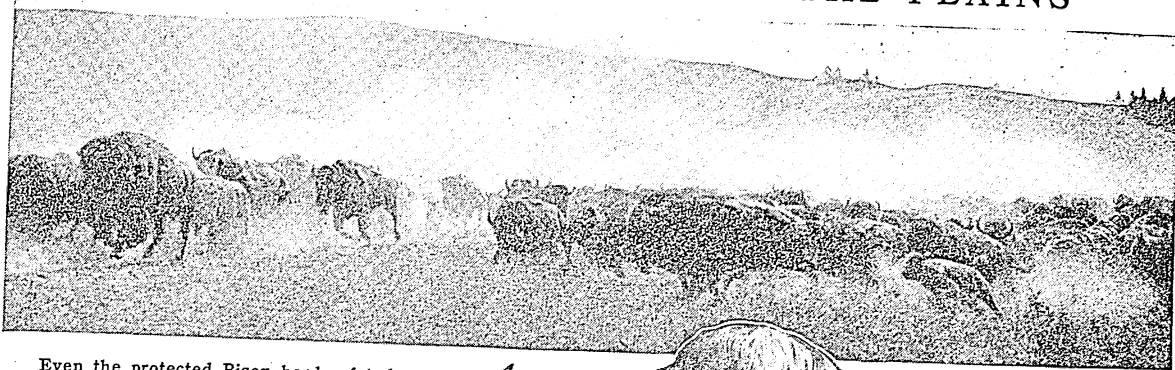
In Bolivia and Germany, large amounts of bismuth occur native. But elsewhere it is usually found associated with ores of lead, copper, tin, and other metals, from which it is separated as a by-product at refineries. The United States, Peru, Mexico, Spain, Canada, Germany, and Japan are the chief producers.

Bismuth belongs to the nitrogen group of elements. It is brittle, lustrous, and white tinged with red. It is slightly heavier and softer than copper. Specific gravity, 9.8. Hardness on Mohs' scale, 2.5. Symbol, Bi. Atomic number, 83. Atomic weight, 209. Valence, 3 and 5.

BISON. The American bison, which is commonly called buffalo (*Bison bison*), is the largest and the most celebrated of all American hoofed animals. Originally it was found on one-third of the continent of North America. Its range extended from Mexico to the region of the Great Slave Lake in Canada, and from Pennsylvania and the Carolinas to the Rocky Mountains. Its food was the herbage of the plain and prairie. The number of bison at the time America was discovered has been estimated at from 30,000,000 to 60,000,000. In 1870 the number of survivors was estimated at 5,500,000. The vast herds sometimes derailed trains in the West and stopped boats on the Yellowstone and Missouri rivers. A traveler in Arkansas in 1871 rode his horse through a great herd and wrote that for from six to ten miles in every direction the whole country was a sea of buffalo. However, the railroads and the introduction of the repeating rifle about this period soon almost completed the destruction of the herds.

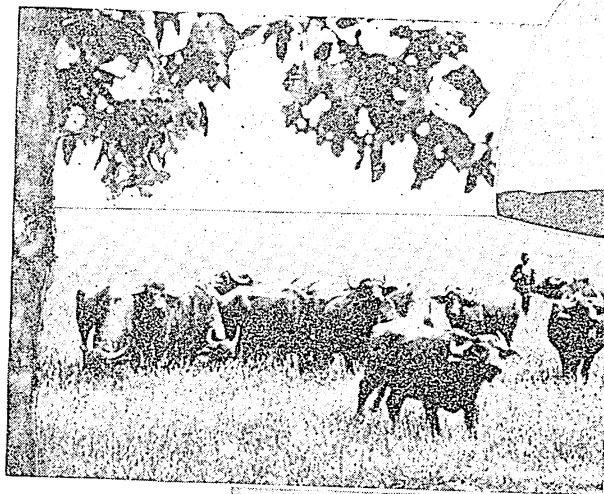
To the Indians of the Great Plains, the bison was the most important game animal. The hides furnished him with the material for teepees and robes. He lived a good part of the time on the fresh meat,

VANQUISHED MONARCHS OF THE PLAINS



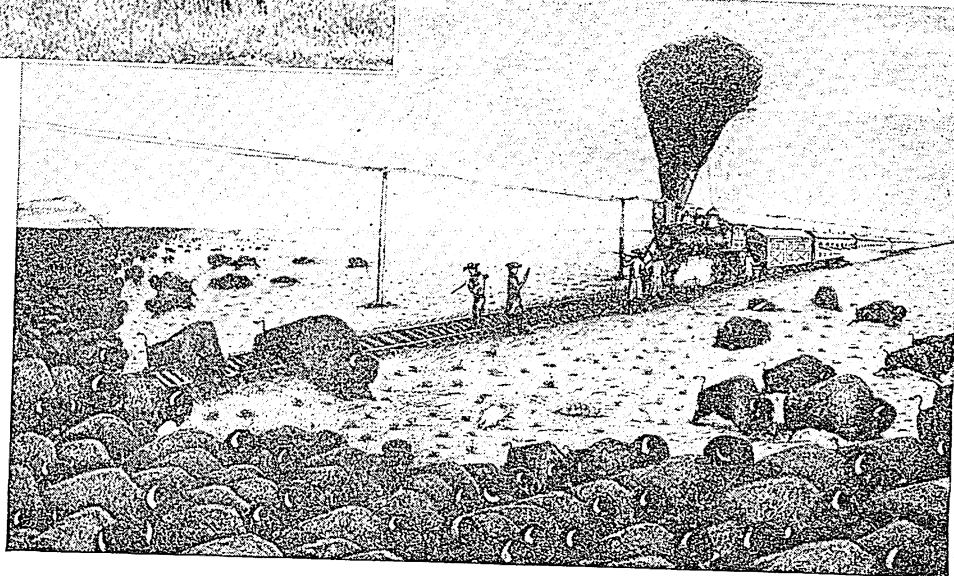
Even the protected Bison herds of today go into stampedes. The thundering herd at the top is re-enacting for a moving-picture camera scenes of the early pioneer days, when Bisons, sole monarchs of the plains, roamed in countless thousands.

Only a few centuries ago the Aurochs, or European Bison, ruled the plains of Europe. Before the World War small herds still were scattered over the continent. Today only a few individuals of the original stock are left. The small herd below is reared on a farm in Hungary, but these animals are not pure blooded stock.



The American Bison disappeared from the plains only a few decades ago, but the Royal Bison has not roamed the earth since the Stone Age. We know of him from pictures drawn and carved by Cavemen artists who hunted him thousands of years ago, and from his fossil remains found on both the American and European continents. This copy is from a mural by Charles Knight in the American Museum of Natural History.

The train hold-up shown in the old engraving at the right took place in 1869. This was a common incident in the history of the first western railways. Often trains were blocked for hours by vast torrents of stampeding bison. Engineers tried running through the masses, but their engines were easily hurled aside, and the stampede went on.



which is almost as good as beef; and for winter the northern tribes made a preparation of the dried meat with berries and fats, called "pemmican." This furnished a nutritious and well-balanced ration in small space. The buffalo dung, as in India, was dried and used for fuel. In 1883 the famous Sioux chief, Sitting Bull, and his band of warriors are said to have slaughtered the last thousand head in southwestern Dakota, leaving less than 1,000 head then alive on the American continent, two-thirds of those being in Canada.

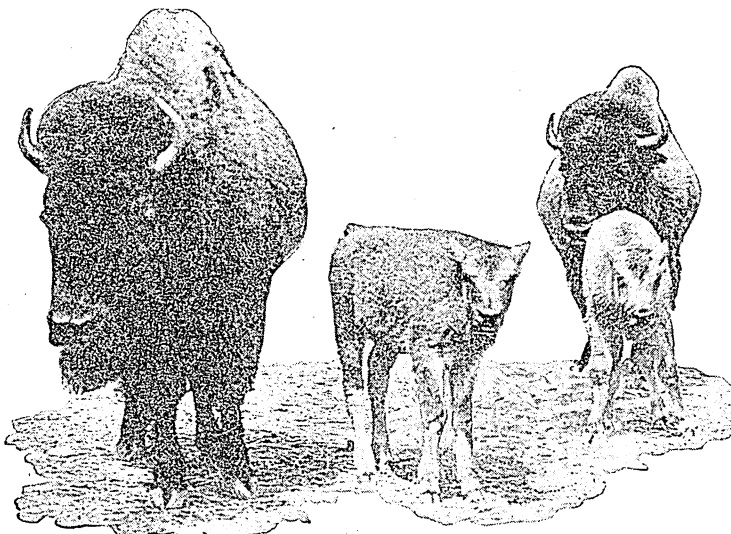
The bison's massive head is his most characteristic feature. His bow-shaped back, different from that of the ox, and the unusually long vertebral spines increase the size of his shoulders.

The convex shape of the frontal bone makes the forehead bulge. Over all the bulk of bone and powerful muscles of the neck and shoulders is the great shaggy coat of curly brown fur, and on the head a black shock of hair like an immense hood. The forequarters are heavier and higher than the haunches, which are much more lightly built.

They Weigh as Much as a Ton

The adult male stands $5\frac{1}{2}$ feet high at the shoulders, is 9 to 10 feet long, and weighs from 1,600 to 2,000 pounds. The largest specimen of which we have an official record was shot in Montana, in December 1886, by Dr. Hornaday, and may be seen in the mounted group in the National Museum at Washington. In spite of this size and bulk, the bison covers ground at a swift gallop. The female buffalo is smaller, for a large cow does not exceed 1,200 pounds in weight. The horns are short and black, and in the males are thick at the base, tapering abruptly to a sharp point as they curve outward and upward. In the female they are more slender. The hoofs are short, broad, and black. The general color is pale brown, darker on the head and shoulders and underneath. The hair on the forepart of the body is 10 to 15 inches long on the head, 6 to 8 inches long on the neck, shoulders, and forelegs, and 10 to 12 inches under the chin, where it resembles a beard and is so called. The hinder and lower portions of the body are covered with short, soft, woolly hair. The tail ends in a tuft of coarse hair 12 to 18 inches long.

BUFFALO MOTHERS AND BABIES



Bison calves are sturdy youngsters who come into the world in May or early June. The cow gives birth to a single calf every year; twins are very uncommon, but the young are so hardy that the protected bison herds are increasing rapidly in parks and fenced preserves.

The long hair on the forepart of the body is permanent but that on the hinder portions is shed annually, beginning in March. By early summer this part of the body is quite naked and very sensitive. In order to escape the attacks of flies and of other insects, the bison seeks out muddy sloughs and

shallow ponds, where it wallows until its body is covered with clay which bakes in the sun and forms a protective armor, lasting for days. The new coat is fine by October, and at its best in November and December. The hide is then valuable as fur. A half-century ago "buffalo coats"—overcoats made of the fur of young bison—were in common use and remarkably cheap. Such coats today would probably

sell for \$500; formerly they sold at from \$12 to \$25. Many a prime "buffalo robe" was obtained from the Indians in exchange for a pound of tobacco or a pint of whiskey.

Under primitive conditions bison herds moved from one feeding ground to another, going northward in the spring and southward in the fall. The southward migrations occurred in immense herds numbering millions of animals. They traveled hundreds of miles, swimming mighty rivers and climbing or descending steep banks, cliffs, and precipices. They followed the same routes year after year usually in single file, making paths that became lasting trails two or three feet deep. The northward movement began in the spring after the calves were strong enough to travel. In this movement they separated into smaller herds, the bulls occupying the outer circle and the cows and calves the inner. When danger threatened, the herd closed in, the bulls facing outward to protect the weaker members.

Victims of Many Enemies

The bison had to cope with many natural foes besides the white man and the Indian. Coyotes and gray wolves lay in ambush for the straggling young calves, though only the fierce grizzly bear could vanquish a bull in single combat. The greatest tragedies came when the ice of rivers and streams gave way under the weight of migrating herds.

It required heroic efforts to save the bison from complete extinction. It was not until 1902 that

Congress took the first steps toward preservation when it appropriated \$15,000 for the purpose of assembling survivors in the Yellowstone National Park. As the bison breeds readily in captivity its numbers have steadily increased. The Canadian herds now contain more than 13,000 head, chiefly on the government ranch at Wainwright, Alberta. There are over 4,000 in the United States, including a large herd in the Lamar Valley, Yellowstone National Park. By crossing the buffalo with common cattle a hybrid animal called the *catalo* has been experimentally produced.

The European bison, called the aurochs or wisent, flourished in Europe centuries ago, and until the World War 1,500 specimens were kept on preserves in the Caucasus and in Lithuania by the czar of Russia. These herds, and all but 50 head of other small herds, are now extinct. A few animals are kept in public gardens in Europe. This bison must not be confused with the extinct wild ox or *urus* of Europe which was originally known as the "aurochs" before its disappearance. The European bison is somewhat smaller than the American, and ranged in smaller herds. Its color is black or deep brown.

By a queer mischance the first skeleton of an American bison, exhibited in Paris in 1819, contained 15 pairs of ribs. As a result of this freak, which probably occurs only once in many thousands of specimens, the report became current that the American bison has 15 pairs of ribs while his European cousin has but 14 pairs.

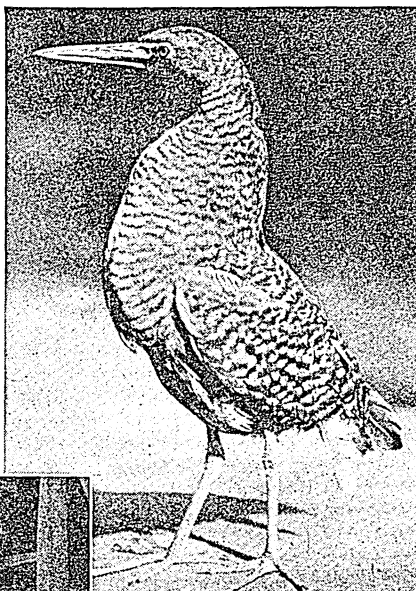
The true buffalo belongs to India and Africa and differs from the bison in the absence of the hump on the shoulders and the long hair on the forepart of the body. (See Buffalo.)

BITTERN. Hunters have named this marsh-bird the "thunder-pumper" or "stake driver," for his call sounds like the driving of a stake heard from a distance. Though his note reaches every part of the swamp, Mr. Bittern himself is hard to find, even when he repeats his call again and again. His song is the most remarkable thing about this "genius of the bog," as Thoreau has called him. As one draws near to his hiding place, the one long note seems to divide itself into three syllables,

plunk-a-lunk, and comes with more of a croaking sound, though seemingly no louder than when first heard. The poet Maurice Thompson well catches the spirit of the bird and its haunts in his verses—

Ho, for the marshes green with Spring,
Where the bitterns croak and the plovers pipe,
Where the gaunt old heron spreads his wing
O'er the haunt of rail and snipe.

The bittern's body is about two feet in length and



he stands from two to three feet high on his long legs. He has a feathered crown on his head, and the plain brownish feathers of his back are exactly what he needs for concealment among the reeds and grasses of the marsh. His breast is yellowish white.

In the mating season, however, the male is gay with white plumes on the neck or breast. The nest of the bittern is built of swamp reeds, and there are three to five eggs of a brownish-gray color. The baby

A Bittern, when it isn't pretending to be dead, is a very live-looking creature indeed; particularly the male, who, as you see, looks as "cocky" as the proud ruler of the poultry yard.

birds are exposed to all the swamp dangers, and minks, muskrats, and water snakes keep the watchful mother always on the defensive.

The bittern is common in both Europe and America. The American bittern breeds in British Columbia and Newfoundland and even as far south as Kansas and North Carolina. It winters in the southern states. The "least bittern" is a small marsh-bird, very shy and rarely seen by man. It nests throughout temperate North America and winters from the Gulf States southward.

Scientific name of American bittern, *Botaurus lentiginosus*; of the least bittern, *Ixobrychus exilis*.



The watchful expression of its yellow eye would be all the sign of life you could detect in a Least Bittern "freezing" on its nest.

BITTERSWEET. Seen against the dry browns of autumn, the bittersweet gives to the woods of most parts of the United States, especially in the Middle West, dashes of glowing color which rival that of any flower. For the bright orange berries, or more properly capsules, burst open when touched by the frost, and curling back disclose the brilliant scarlet fruit within. The bittersweet is a treelike vine which does not cling gently like the ivy, but twines its woody stem about trees with great strength, some-

times killing young saplings. Not only does it twine about other vegetation, but it "often outdoes the kitten that plays with its own tail, twisting its own stems together, frequently into a rope of great strength." The small inconspicuous creamy-white flowers appear in June. The berries reach their full development in September, and if gathered then and allowed to dry, will brighten the house all winter. Scientific name, *Calastrus scandens*.

The European bittersweet (*Solanum dulcamara*) is a totally different vine. It is a member of the nightshade family and bears drooping clusters of blue or purplish flowers, shaped like potato blossoms but much smaller. These blossoms give place to tempting-looking but poisonous berries about one-half an inch long, which turn from orange to red. From the twigs a fluid extract is prepared which is sometimes used in medicine.

BJÖRNSON, BJÖRNSTJERNE (*byërnst'yër-nā byërn'son*), (1832-1910). "When his name is mentioned it is like hoisting the flag of Norway," so the critic Georg Brandes once said of Björnson, the most loved and the most representative of Norwegian writers. The author of Norway's national hymn, her greatest novelist, and, next to Ibsen, the greatest dramatist of his country, Björnson embodies the finest qualities of the Norwegian people.

He was born in Kvikne, a little village in central Norway, where his father was a Lutheran pastor. He was educated at the University of Christiania, but left without completing his course in order to devote himself to journalism.

His first novel, 'Synnöve Solbakken', published when he was 25, made a deep and lasting impression. It was the first of a series of tales of Norwegian peasant life, written in the simple and charming style of the old sagas. 'Arne', published in the following year, is perhaps the best of all these stories; it contains the beautiful song, 'Over the Lofty Mountains', which first showed Björnson's ability as a poet.

Björnson was also deeply interested in the drama. He was made director of the theater at Bergen, and was granted a government stipend to enable him to travel in Italy, France, and Germany. He wrote a number of dramas based on the history of Norway and then turned, like Ibsen, to the social problems of the day. He took a more hopeful optimistic view of these problems, however, than did Ibsen. As someone has said, while Ibsen expressed the doubt, Björnson expressed the faith of his people. He was less stern and cold, more gentle and sympathetic, than Ibsen.

As a newspaper writer and editor, and as a political orator, Björnson kept in close touch with the life about him and played a prominent part in the affairs of his day. A strong nationalist, he helped to bring

about the separation of Norway from Sweden, which took place in 1905. In 1903 he was awarded the Nobel prize for the most important literary work of that year. Long before his death, in 1910, his books had been translated into English and the continental languages, so that his literary fame was world wide.

Among his best stories and novels are: 'Synnöve Solbakken' (1857); 'Arne' (1858); 'A Happy Boy' (1860); 'The Fisher Maiden' (1868); 'The Heritage of the Kurts' (1884). His dramas include: 'Between the Battles' (1857); 'Sigurd Slembe' (1861); 'Sigurd Jorsalfar' (1872); 'The Newly Married Couple' (1865); 'The Editor' (1874); 'A Bankruptcy' (1874); 'The King' (1877); 'The New System' (1879); 'The Gauntlet' (1883); 'Beyond Our Power' (Part I, 1883; Part II, 1895).

BLACKBERRY. Only in the United States is this fruit-bearing shrub cultivated, though it is abundant in the British Isles, where it is usually known as the "bramble." It belongs to the same genus as the raspberry, from which it is distinguished by its plumper and larger berry, and by the fact that the conical receptacle comes away with it when the berry is picked. More than 25 varieties have been developed in this country, among them a white thornless variety. They are propagated chiefly from suckers and root cuttings. Blackberries belong to the genus *Rubus*. The trailing or low blackberry (*Rubus canadensis*) is often called the "dewberry."

BLACKBIRD. The "four-and-twenty blackbirds" of the Mother Goose pie were singers, but American blackbirds do not sing. Indeed, only the "redwing"

has even a musical call. Of the 12 species, only the male birds have really black plumage. The females are rusty gray-brown with light markings and the young are like their mothers.

Most blackbirds love swampy places, and most of them weave their nests fast to reeds close above watery ground. Their three to six eggs are grayish-green, spotted and streaked with brown. They live in flocks rather than pairs, and in autumn tens of thousands together fly off south for the winter. In parts of the south, in the rice areas of the Gulf coast, Arkansas, and the Sacramento valley, red-winged blackbirds have become a serious pest, doing immense damage to rice and other

small grains. In the north, however, they are frequently useful to agriculture in destroying weed seeds and insects.

Of the American blackbirds the "redwing" is the greatest favorite; he is jet black, with gold bordered epaulets of red (for illustration in colors see Birds). The "yellow-headed" blackbird is the Beau Brummel of the family, for he has an orange-colored head and breast, with a touch of white on each wing. The purple "grackle"—the giant of the family, reaching a length of 12 inches—has black plumage with showy

"MOTHER'S BACK FROM MARKET!"



A mother Blackbird is here seen returning to her woven nest among the reeds with a little luncheon for the babies—a nice fat bug.

metallic lights. He is handsome in appearance, but his note is like the creaking of a rusty hinge and he has a bad reputation as a robber of nests. Brewer's blackbird, which is found in the western part of the United States and Canada, is another handsome member of the family.

In Europe the name "blackbird" is given to a totally different bird, belonging to the thrush family, which is a beautiful songster and makes a good cage bird.

Another well-known member of the family *Icteridae*, to which the blackbirds belong as well as the orioles and bobolinks, is the "cowbird" or "cow blackbird." Like the European cuckoo, the cowbird is a parasite, laying its eggs in the nests of other birds. It gets its name from its habit of following cattle to feed on the insects which flee from the browsing herds. Scientific name of redwing, *Agelaius phoeniceus*; of the yellow-headed, *Xanthocephalus xanthocephalus*; of the purple grackle, *Quiscalus quiscula*; of cowbird, *Molothrus ater*.

BLACK DEATH. "I leave parchment for continuing the work if haply any man survive and if any of the race of Adam escape this pestilence." So wrote a despondent English monk in his chronicle, while the terrible plague called the Black Death raged in England in 1349. And well might he despair, for this epidemic swept off at least a third of the population of Europe in four years.

In France the ravages were as great as in England. "It is impossible to believe the number who have died throughout the whole country," wrote a French monk. "Travelers, merchants, pilgrims, declare that they have found cattle wandering without herdsmen in fields, towns, and waste lands. They have seen barns and wine-cellars standing wide open, houses empty, and few people to be found anywhere. In many towns where there were before 20,000 people, scarcely 2,000 are left. In many places the fields lie uncultivated."

Not only did the Black Death carry off large numbers of people, but it also acted very quickly. A person began to shiver, his temperature rose, swellings appeared in the neck, armpits, or groin, and frequently death resulted in 12 hours.

In many ways the Black Death helped to bring to a close the Middle Ages. In England before the plague there were about four or five million inhabitants; when the pestilence had passed away there were only about half this number. Field laborers had become scarce, and those who were left demanded greatly increased wages. Many peasants left the estates of their masters and fled to the towns, or found places elsewhere where their lot was easier. Parliament passed laws to keep wages and prices at their former levels, but these could not be enforced. As a result the old manorial system of labor and agriculture broke down in England and a new system gradually took its place. In the new system the land was either rented to tenant farmers, who paid money for its use instead of giving their services in return, or else the land was retained by the lord and put into pasture for sheep.

The Black Death was only one of the many visitations of that disease which today we call the "bubonic plague." During the Peloponnesian War it broke out in the city of Athens (430 B.C.). In the reign of the Roman Emperor Justinian grain-ships from Egypt brought it to Constantinople. Boccaccio places the scene of his 'Decameron' on the hills about Florence, Italy, during the epidemic of 1347. Defoe describes the outbreak of 1665—the "Great Plague"—in London.

The home of the bubonic plague is in Asia and we now know that it is carried by a certain kind of flea which lives on rats. With the advance of medical science and sanitation its ravages have been checked in the western world, but constant vigilance is still required on the part of health officers at seaports to prevent its revival.

BLACK FOREST, GERMANY. Tales of dwarfs and elves and fairies haunt every valley and wooded height in the famous Black Forest of Germany, for scores of the nursery tales grew up in the mysterious depths of this wooded mountain region.

The Black Forest lies in the elbow formed by the River Rhine as it flows westward from Lake Constance and turns sharply to the north. Stretching away to the north—mile after mile—are the rounded mountains crowned with dark belts of pine and fir, and so the people long ago called them *Schwarzwald*, meaning "black forest." Where the sun breaks through the dense foliage, there are great cathedral-like spaces where fairies meet, according to popular belief. In the narrow valleys lie hamlets scattered along the streams, while here and there are isolated dwellings, partly hidden by fruit trees, looking down from sunny slopes or projecting their quaint gables from a forest background. The length of the chain is about 100 miles and its average width is 24 miles. The loftiest elevation is the round-topped Feldberg, 4,898 feet high. To one coming from the towering snow-capped peaks of the Alps, which lie about 100 miles to the south, the Black Forest seems in comparison but a mass of gentle wooded hills.

Unlike the forests of the United States and Canada, the woodlands of this region are beautifully kept. A tree felled by the wind or blasted by lightning is immediately removed, and all broken twigs and branches are speedily cleared away to be used for fuel. The upkeep of the forest furnishes the inhabitants with their chief means of support. Land which in America would be useless waste here supports groves worth thousands of dollars an acre.

Here and there are nurseries in which each spring are planted the seeds of a future forest. The pine and fir predominate, but in order to provide for every locality, other varieties are sown, such as maple, ash, birch, walnut, and even fruit trees. The groves planted by one generation are cared for by the next, and are cut down and sawed into lumber by the third.

The beautiful Danube and Neckar rivers rise in these mountains. Along these and other streams are

THE INLAND SEA THAT DIVIDES AND JOINS EUROPE AND ASIA



Since men first went down to the sea in ships, the Black Sea has been important in world history. The legendary Jason crossed it in search of the Golden Fleece, and merchants of both ancient and medieval times used it as a trade route to bring the precious wares of the Orient to the Western World. The Crimean Peninsula, which juts into it west of the Sea of Azov, was the scene of the Crimean War. An extraordinary fact is that below 80 fathoms its waters are poisonous and contain no living creatures.

little manufacturing towns. Cattle graze on the grassy slopes, and the beauty of the region makes it a favorite summer resort. The greater part of the Black Forest is in the state of Baden (see Baden).

BLACK SEA. This great sea lies between Turkey on the south and Russia on the north, and between Bulgaria and Rumania on the west and the Russian Caucasus Mountains region on the east. It is five times the size of Lake Superior and one-sixth as large as the Mediterranean. It connects with the Mediterranean through the Bosphorus and the Dardanelles.

Lying where Europe and Asia meet, the Black Sea has been important for 30 centuries. It has been traversed by ships of early pirates, traders, and settlers, and by vessels of modern commerce and war. For Russia this sea, with its Mediterranean outlets, is a vital necessity, and it has figured since the 18th century in that country's history. The fact that the Turks were able to block the entrance at the Dardanelles in the World War of 1914-18 tended to prolong that struggle and contributed to Russia's defeat.

In the second World War, the Black Sea again became an important prize. Germany made some of its mightiest drives through the regions to the north and northeast of the sea in an effort to wrest from Russia the grain lands of the Ukraine and the rich oil fields of the Caucasus, and to gain control of Russia's southern seaboard.

Including the Sea of Azov, the area of the Black Sea is about 170,000 square miles. Its greatest length is

750 miles, its greatest width 380 miles, and its greatest depth 7,350 feet. It has no important islands and practically no tides. Its harbors are usually ice-free the year round.

The Black Sea drains nearly one-quarter of the surface of Europe. The large inflow of fresh water makes it much less salt than the ocean and sets up a peculiar current. In the upper levels fresh water flows outward toward the Bosphorus; in the lower levels salt water from the Aegean Sea flows inward. The great rivers that empty into the Black Sea are the Danube, the Dniester, the Bug, the Dnieper, the Don, and the Kuban. Where rivers and railroads meet the sea, many ports have grown up. But the coast line is so unbroken that almost all the harbors are artificial. Sevastopol, the only natural harbor of consequence, is Russia's principal naval base on the Black Sea. Other larger ports are Constantia, Odessa, Nikolaev, Kherson, Novorossisk, Trebizond, and Samsun. From these ports are shipped oil, wheat, and lumber as well as tobacco, rugs, and other specialties of the region. Manufactured goods are the chief imports.

Because the Black Sea was dangerous to the small ships of ancient times, the early Greeks called it *Axeinos* ("unhospitable"). Later, in the 7th century B.C., when they colonized its shores, they renamed it *Euxeinos* ("hospitable"). It is no more hazardous than other inland seas of its size.

After capturing Constantinople in 1453, the Turks closed the sea to all but their own ships. Russia later obtained rights for its vessels. In 1923, by international agreement the straits were opened to all peacetime commerce. (See also Dardanelles.)

BLAINE, JAMES GILLESPIE (1830-1893). The "plumed knight" of the Republican party, Blaine, like Webster, Clay, and Calhoun, disappointed himself and his many friends by just missing the presidency. Born in Washington County, western Pennsylvania, he graduated at 17 from Washington College and at 26 was editor of the *Kennebec Journal*, of Augusta, Me. He helped organize the new Republican party in Maine, and was a member of the state legislature. He went to Congress, where he was speaker for three years, then to the United States Senate. He was secretary of state under presidents Garfield and Harrison. In 1876 and again in 1880 Blaine failed to win the Republican nomination for the presidency, and when he did get it, in 1884, he lost the election to Cleveland, largely because thousands, even in his own party (called "Mugwumps" in the 1884 election), distrusted him. His book, 'Twenty Years of Congress' (1861-81), is of historic value.

BLAKE, ADMIRAL ROBERT (1599-1657). The memory of Blake, the greatest English admiral next to Nelson, is dear to the English people. He was born in Bridgwater, spent nearly ten years at Oxford, and was chosen by his Puritan fellow-townsmen as their representative in the Short Parliament. When civil war broke out in 1642, he joined the parliamentary forces, aided in the capture and defense of Taunton, and was then asked to assume a high command in the navy. He built up the fleet and hunted the royalists from the high seas, winning notable victories at Cartagena and the Scilly Islands.

In the struggle for commercial supremacy between England and Holland, Blake, often with odds heavily against him, defeated the Dutch admirals De Ruyter and Tromp again and again. His success was decisive and far-reaching. Since his day, British supremacy at sea has never been successfully challenged.

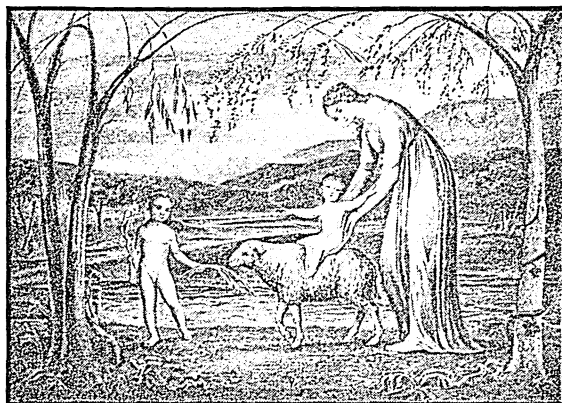
Blake further served his country by administering a sharp lesson to the Barbary pirates. His most spectacular feat was the crushing defeat in 1657 of a Spanish fleet in the Canary Islands, under the guns of a castle and several powerful forts. On his way home from this victory he died. He was buried in Westminster Abbey, the first seaman to be thus honored.

Blake was a worthy successor to Drake and predecessor of Nelson. He won his remarkable victories by a combination of military genius and audacity.

BLAKE, WILLIAM (1757-1827). In a single room in a humble part of London, William Blake, by a process of his own, etched words on copper, decorated the plates with designs of singular beauty, and added an occasional full-page picture. The book was 'Songs of Innocence', a collection of 20 poems written by Blake himself. The 27 illustrations were from his paintings. He blended the ink, ground the colors, and mixed his own paint. Catherine, his wife, made impressions, tinted the prints, and bound them neatly in boards. They must have laughed gaily together when the first volume was finished, for they had

made everything but the paper! That was in 1789, and the book sold for a few shillings. Today a copy is worth thousands of dollars.

William Blake, poet, artist, designer, and mystic, was born in London, Nov. 28, 1757, the son of a hosier. He developed his talent for sketching at drawing school and by copying prints of old masters. At 14 he was apprenticed to an engraver; at 24 he had married and opened an engraving shop. In the poetry and painting of his leisure hours, he developed a haunting mysticism whose beauty was not appreciated until long after he was dead. Publishers took advantage of him; rival artists stole his ideas and reaped rich profits while Blake himself fared poorly. He died



This painting of 'The Infant Jesus Riding on a Lamb' is typical of Blake's work as an artist.

Aug. 12, 1827, and was buried in an unmarked grave. Not until 100 years later, in 1927, was a tablet erected over his supposed resting place.

'Songs of Innocence' and its later companion volume, 'Songs of Experience', are his best known works. The second includes his famous 'Tiger! Tiger! Burning Bright'.

Blake's fame as an artist and master of design rests largely on a set of 21 copperplate etchings, his dramatic interpretation of the Book of Job. He illustrated Richard Gough's massive work, 'Sepulchral Monuments of Great Britain', produced between 1786 and 1796. For his models he spent hours in the dim vaulted aisles of Westminster Abbey, copying the Gothic figures.

BLEACHING. Cotton, linen, wool, paper, oil, wax, and many other substances must be whitened by chemical bleaching. Once they were boiled in caustics and exposed to the sun repeatedly, a long process in which the Hollanders excelled in the 18th century. The task was shortened by the discovery in 1790 of the bleaching powers of chlorine gas in contact with water. Best of bleaches is chloride of lime, which releases oxygen when dissolved in water. Fabrics of vegetable origin are usually bleached with such oxidizing agents; wool and silk with reducing agents, that is, those that absorb oxygen. However, peroxide of hydrogen, a powerful oxidizer, is valuable for bleaching silk as well as vegetable fibers.

BLIGHT. When plants dry up and shrivel, or turn yellowish or brown, or when the fruit decays early, the plant doctor says that it is probably an attack of "blight." Very often this is caused by a mildew attacking the leaves, but it may be due to a poor supply of food and air at the roots.

Blights of grains are called "rusts" or "smuts," because they make the grain look reddish or black. Some other common blights are "scab" and "rot" of potatoes, "beet-root rot," "peach leaf curl," and "apple scab." (See Mildews and Molds; Rusts and Smuts.)

BLIND, EDUCATION OF. Blind, deaf, and dumb! Can you imagine a more pitiable plight for a two-year-old child? This was the situation of little Laura Bridgman, about a hundred years ago; but, nevertheless, she became a cheerful, happy citizen, and did a great deal for the happiness of others. An attack of scarlet fever in 1831 left her completely shut out from the world, save for her sense of touch, and her life seemed completely blighted.

When she was eight years old, however, Dr. Samuel G. Howe, superintendent of the Perkins Institute for the Blind in Boston, undertook the untried task of developing a mind thus doubly barred. First the child was given a spoon and a fork on which were labels with the raised letters F-O-R-K and S-P-O-O-N. Gradually the connection dawned upon her, and when the labels were removed she could replace them on the proper articles. Then the letters were separated, and patiently she was taught to assemble them again so they would spell the words. This process was repeated with other articles, until finally she was familiar with the whole alphabet, and knew how to spell many names of simple objects.

Now she was ready to learn finger spelling. A raised letter would be given her, and, with Laura's delicate fingers "watching" closely, the deaf-and-dumb sign of that letter would be formed by the teacher. Soon she was "writing her thoughts on the air" with astonishing rapidity, and by feeling with her hands the signs made by the person conversing with her, she was soon "talking" with them. This education continued until she was 20 years old, and she developed into an unusually skilful teacher of blind children and was happily employed earning her own living until her death in 1889.

The Beginning of a New Era

Laura Bridgman did not have the brilliant mind of that other famous blind deaf-mute, Helen Keller, and did not achieve such spectacular results (see Keller, Helen). But her education was the greatest accomplishment of the comparatively new art of teaching those similarly afflicted. Up to the beginning of the 19th century, scarcely any attempt had been made to ease the lot of the blind and to teach them to

support themselves. Today by far the greater number of blind persons in progressive countries are educated, independent, self-supporting citizens. For this change much of the credit is due to the blind themselves—to their eagerness to learn and their untiring devotion to their tasks.

Books for the blind now for the most part are not printed in raised letters, but in an alphabet of raised "points" so arranged as to represent the different letters. This method was invented in 1829 by Louis Braille, who became one of the best organizers in Paris and a noted educator of the blind. As a child he delighted to play in his father's saddlery shop, punching holes in the scraps of leather with an awl. One day the sharp tool slipped, injuring his eye so severely that

he became totally blind. He thought a great deal about the little marks the awl left in the leather, and the idea came that if the awl were punched only half way through, a dot would be raised on the other side. With this as a basis he worked out a system whereby different variations of groups of little raised dots represented letters of the alphabet, special word and syllable signs, and punctuation marks. Educators seized upon this system, and with modifications it is taught in every country where there are schools for the blind. To persons whose fingers are not sensitive, it seems as it did to the newly blinded soldier, who, running his finger over the page, exclaimed disgustedly, "Aw, it feels just like a sheet of sandpaper." But to thousands who have mastered its characters it has opened a new world of happiness.

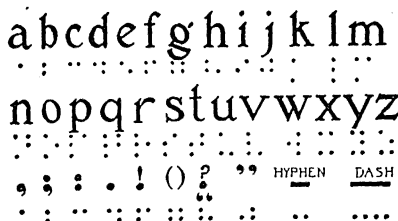
The "American braille" and "New York point" alphabets formerly used have now given way to the Revised braille shown in the illustration above.

Typewriters have been invented for writing all these systems, and machines for embossing the characters on brass plates, so that any number of impressions may be printed.

Books for the Blind are Costly

A large number of books and several magazines are printed in braille as well as in raised letters. Both kinds of books for the blind are much more expensive than printed books. Dickens' 'Old Curiosity Shop', for example, which can be obtained at the bookstores in prices ranging from 50 cents to \$1.50, costs \$17.50 in braille, and is bound in six fat volumes. So most blind people have to depend on their school libraries, on public libraries in the larger cities which have collections of such books, and on state libraries which make the circulation of books for the blind a part of their work. The United States government aids the work by permitting such books to be sent through the mails under a "frank," that is, without postage.

The alphabet of raised Roman letters in combina-



You see how simple the Braille alphabet is—just a few little dots in various positions that to the sensitive fingers of the blind soon come to convey the precious message of books.

tion with certain other characters is still valuable for those who are too old to learn the new method or whose fingers are not sensitive enough. But to be legible the letters must be large, and this makes the books too bulky for ordinary use.

For writing braille by hand, a grooved board is used with a perforated metal rule to serve as a guide, and the points are impressed on soft paper with a metal pencil. This is read on the reverse side. Writing braille is a tedious process, so in most institutions for the blind the use of the braille typewriter is also taught. For writing to the seeing, advanced pupils are taught to use as well an ordinary typewriter. The "touch" system now universally used by stenographers was originally devised for the blind. Special touch devices are employed to teach geography, arithmetic, and natural history to the blind.

There are also various devices for converting light impulses into sound, so that the blind may *hear* the books they cannot see (*see Selenium*).

The United States government, through the Vocational Education Board, accomplished wonderful results in retraining the soldiers blinded in the World War of 1914-1918. Here the work was different from the teaching given in the schools for the children who have always been blind; for blind soldiers, like other adults blinded by accident, are forced into a new sort of life. The vocational schools retrained the majority of blinded soldiers to take a fairly independent place in normal life. The braille system of reading was taught, and instruction was given in anything the soldiers desired to adopt as a business or a "paying hobby."

In the United States, schools for the blind form a part of the public school system. Blind children are given much the same sort of instruction as those who can see, and are also trained in some profession or handicraft by which they will be able to earn a living.

Many blind persons are engaged in farming. Many of them excel as musicians, and a considerable proportion of the graduates of schools for the blind become piano tuners. Basketry and broommaking are other occupations especially suited to the blind.

BLOCKADE. During the Civil War in the United States, the most daring sea captains of the Confederacy and some neutral powers were employed to break through the lines of the Union warships block-

ading the Southern seaports. In the dead of night, their swift gray ships, loaded with munitions and food supplies for the Confederate states, or with cotton for England, would try to steal past the patrolling vessels. But often creaking rigging or swishing water under the bow would bring a hail out of the darkness: "Ship, ahoy! Haul to, or I fire!" If the blockade runner tried to flee, a flaming broadside would thunder from a Northern man-o'-war. Captured ships and goods were confiscated as prizes.

This war measure, which closed the Southern ports and ultimately starved out the Confederacy, is a notable example of the naval operation known as *blockade*, by which a nation attempts to cut off its enemy from commerce with the outside world. International law governing blockade is based chiefly on the Declaration of Paris of 1856 and the Declaration of London of 1909. These require that a blockade must be formally declared, that it must not extend beyond the coasts of the enemy, and that it must be maintained by sufficient patrol forces to render it effective. This latter requirement was designed to prevent a mere "paper" blockade used as an excuse for the surprise capture of vessels bound for a "blockaded" port.

The development of airplanes, submarines, and sea mines makes a close blockade of the enemy's coast impossible in modern warfare. Hence, in both World Wars, Great Britain and Germany alike extended their blockades far out on the oceans and endeavored to prevent all shipments from reaching the enemy. These measures of "long-range" blockade were protested by neutral nations as violations of international law. In both wars Germany ruthlessly sank neutral and enemy merchant shipping wherever it was found and without regard to the safety of crew or passengers. (*See also Civil War; International Law; World War of 1914-1918; World War, Second.*)

A *pacific blockade* may be used in peacetime to coerce another nation, but the ships of nations not party to the dispute are left unmolested.

BLOOD—the LIFE STREAM of the BODY

BLOOD. In the most exact sense, blood is our life stream. It carries food and energy to all parts of the body. It helps to keep our temperature within the narrow limits in which our cells can stay alive. It carries away the wastes that would otherwise poison us. And it fights off the constant attacks of the bacteria of disease and decay.

When the blood ceases to flow, life ends. Let the supply of blood to the brain stop for only a second and consciousness stops. The aviator leveling off after a power dive suffers a "blackout" because the violent change of direction momentarily drains blood from his head.

Blood normally accounts for about 1/13 of our total weight. A man weighing 155 pounds thus has about 12 pounds of blood, making about 5½ quarts. How

it is pumped out from the heart, how it is carried by the arteries into the tiny capillaries throughout the body, how it returns through the veins to the heart and lungs—all this is told in the articles on Heart, Lungs, and Respiration. Here we shall see what the blood is made of and how it does its many tasks.

The blood is a mixture of liquids and solid particles. Most numerous of the particles are the *red corpuscles*, which give the blood its color. There are about 300 million of them in a drop. Thinly scattered among them are the larger *white corpuscles*, about one to every 700 of the red, and the tinier *platelets*, about one to every 20 red corpuscles. The liquid in which these particles are suspended is called the *plasma*. Each part of the blood is marvelously adapted to the special work it has to do.

The red corpuscles, also called *erythrocytes* ("red cells"), are button-shaped, slightly concave on each side. They are so small in diameter that 3,200 of them, placed edge to edge, would measure hardly an inch. They are so thin that it would take more than 11,500 of them to make a stack an inch tall.

Each red corpuscle is a sac, enclosing a material called *hemoglobin*. This consists of hematin, a substance containing iron, and globin, a protein. Because there is iron in the hematin, the hemoglobin unites readily with oxygen.

The Work of the Red Corpuscles

The work of the red corpuscles is to carry oxygen from the lungs to the tissues and cells throughout the body. In the lungs, the hemoglobin picks up oxygen to form oxyhemoglobin. This is what makes the blood in the arteries (arterial blood) bright red. As the red blood moves on from the arteries into the capillaries, the corpuscles give up their oxygen, which diffuses out through the capillary walls and is used in the activities of the cells. In exchange the cells give up carbon dioxide, a waste product, and the red corpuscles carry some of it back to the lungs.

When the oxygen leaves them, the red corpuscles turn purple, and this is the color of the blood in the veins (venous blood). Venous blood sometimes looks red when exposed to air because the hemoglobin on the surface turns to oxyhemoglobin.

The red corpuscles are born in the red marrow of the bones. At first, each has a nucleus but loses this on entering the blood stream. There the cells last from 10 to 30 days. When worn out they break up as they pass through the spleen, and their iron content is carried to the liver. Here the iron is stored until the bone marrow needs it for making new red corpuscles. It is estimated that 10 million red cells are born and an equal number are destroyed during each second of a man's life.

The Work of the White Corpuscles

There are two chief kinds of white corpuscles. About 74 per cent are the kind called *leucocytes*, and 22 per cent are the kind called *lymphocytes*.

A leucocyte is a round semitransparent cell, consisting of a many-lobed nucleus surrounded by protoplasm (see *Cell*). It is about one-fourth larger than a red corpuscle. Unlike a red corpuscle, which is circulated only by the blood stream, the leucocyte can move independently. It moves like an amoeba by changing its shape (see *Amoeba*). It can even work its way through the walls of the capillaries.

The job of the leucocytes is to police the blood. They engulf and devour and carry away harmful bacteria and other foreign substances. Because eating is their main job, they are sometimes called *phagocytes* (from the Greek *phago*, "I eat"). When bacteria enter the tissues through a break in the skin, the leucocytes come out by the thousands from the near-by capillaries and attack them. Many leucocytes die in the battle, but reinforcements move in constantly. The resulting accumulation of dead bacteria, and leucocytes, blood,

dead tissue cells, and cell fragments is called "pus." An exceptionally large accumulation of pus is called an "abscess."

The leucocytes, like the red corpuscles, are born in the red marrow of the bones. They spend their lives both in the blood stream and in the lymph which surrounds the cells. We shall explore the lymphatic system later. The leucocytes not killed in battle are destroyed at last in the spleen, the bone marrow, and the lymph nodes.

A lymphocyte is smaller than a leucocyte and has a large bean-shaped nucleus. It helps to repair the tissues damaged in the battles between leucocytes and bacteria. Lymphocytes are born in the lymph nodes and other lymphatic tissue.

About 4 per cent of all the white corpuscles are large round cells called *monocytes*. Their protoplasm is clear, and their nucleus horseshoe-shaped. They are phagocytic, and are believed to help the leucocytes to free the blood of foreign matter. They are thought to originate in the lymph nodes.

The Work of the Blood Platelets

The tiniest particles in the blood are the *platelets*. They are only from one-fifth to one-tenth the diameter of the red corpuscles and have scalloped edges. When platelets come into contact with air or with any other foreign substance they disintegrate, liberating an enzyme (thrombokinas), which helps the blood to clot. The origin of the platelets is unknown. They may be fragments of red corpuscles or they may be made independently in the red bone marrow.

Plasma, the Vital Liquid

The red and white corpuscles and the platelets make up together somewhat less than one-half the volume of the blood. The rest of the blood is plasma. About 90 per cent of this plasma is water, in which are dissolved at one time or another virtually all the tissue-building materials, the life-controlling chemicals, and the wastes of the body.

The complete story of the plasma is the story of respiration, because it transports both oxygen and carbon dioxide (see *Respiration*). It is the story of digestion and metabolism, because it carries digested food to the cells for use in their activities (see *Digestion*). It is the story of the glands and of the hormones and other substances they secrete, because it is through the plasma that these substances travel to the cells, tissues, and organs to regulate and coordinate the activities of the body (see *Gland*). The numerous vaccines, and antitoxins, and the blood antiseptics of the "sulfa" type do their work through the plasma (see *Antiseptics*; *Antitoxins*; *Vaccination*).

The contents of the plasma include many nitrogen compounds, such as amino acids, urea, and certain proteins like albumin. They include sugars and fats and the mineral salts necessary to life (see *Biochemistry*; *Minerals*).

The plasma carries all these things along with the corpuscles and platelets. It is like the water of a

great stream, and the body's cells, tissues, and organs are like ports where the stream picks up some cargoes and discharges others. It transports wastes and delivers excess foods into the liver and other storage regions. It supplies the sweat glands and the digestive glands.

Throughout all these transactions, the chemical composition of the plasma remains almost constant. This is necessary to maintain life. Should the blood become more dilute, the red corpuscles would swell and burst. Should it become more concentrated, the red corpuscles would shrivel. Thus the water taken by the plasma from the intestines is balanced by the amount it gives off through the kidneys. All its exchanges are made through the walls of the capillaries. (See also Kidneys; Liver; Lungs; Skin.)

One of the characteristic substances in the plasma is a protein called fibrinogen ("clot hastener"). It works with the platelets to form a clot when the blood is exposed to air. First it produces a threadlike substance called fibrin. This enmeshes the corpuscles like a net and then shrinks to prevent further outflow of blood from the cut. A fluid called the *serum* is pressed out by the shrinking of the fibrin. Serum then is simply the blood plasma from which the fibrin has been removed.

Lymph, the Blood's Pale Ally

Closely allied to blood is lymph, a clear, yellowish liquid which surrounds all the body cells. It is through the lymph that the cells receive oxygen and food from the blood and send waste products back to the blood. Lymph is made up of those parts of the blood which have worked their way out through the walls of the capillaries and into the surrounding tissues. It has no red corpuscles and it contains much less protein than blood plasma.

The lymph circulates constantly. After reaching the cells, it returns to the blood stream by two routes. It may simply pass back through the walls of the capillaries or it may return through the *lymphatic system*. This consists of a network of vessels draining all parts of the body and converging finally in a large duct (the *thoracic duct*), which discharges into a vein in the upper part of the chest.

Pressure on the walls of the lymph vessels caused by breathing and other bodily activities keeps the lymph in motion. But it can flow only in one direction, since these vessels are equipped with one-way valves. This method of circulation resembles the one that drives blood back through the veins toward the heart.

Along the lymph vessels lie enlargements called lymph nodes, especially abundant in the neck and under the arms. The nodes filter out solid particles, such as dust and soot, which enter the lymph capillaries from the lungs. Bacteria that get into the lymphatics are attacked by the lymphocytes in the nodes.

It is also the function of the lymph to carry digested fats. These fats do not enter the blood directly, but pass first into special lymph vessels (the *lacteals*) in the small intestine and thence through the lymphatics into the blood (see Physiology).

Blood and Temperature

The body is continually transforming chemical and mechanical energy into heat, which is carried off by the air coming out of the lungs and by radiation from the skin. To maintain the normal temperature of 98.6° F. in all kinds

of weather, the amount of heat lost by the body must be regulated. This is in part done by the action of sweat glands (see Skin). But a large part of the control is exercised through the blood capillaries. In the cold the temperature-regulating nerves cause the capillaries of the skin to contract; thus less blood circulates near the surface and less heat is lost by radiation. In warm weather the capillaries expand, increasing the heat loss.

Blood Tests and Blood Deficiencies

Blood tests are widely used in medical diagnosis. They take into account the proportion of red and white corpuscles and the chemical composition of the plasma. A simple "blood count" is made by counting under the microscope the number of red corpuscles in a standard sample of diluted blood and computing the number per cubic millimeter. About 5 million is normal. A "differential count" shows the proportion of the different types of corpuscles and requires that the sample be treated with dyes to make the white corpuscles visible. The normal total for all white cor-

DRYING PLASMA FOR TRANSFUSION



This man is examining a tray of plasma which has been drying in a vacuum chamber. When the door of the chamber is closed, the air is drawn off and the moisture in the plasma rapidly evaporates.

puscles is from 5,000 to 9,000 per cubic millimeter. The chemical tests ("blood chemistry") determine such things as the excess or deficiency of calcium, phosphorus, sugars, proteins, urea, uric acid, and cholesterol.

Anemia is the general name for deficiencies in the number of red corpuscles or in the amount of hemoglobin they contain. Some anemias are merely signs of faulty diet. Others are deep-seated diseases, like pernicious anemia, which was invariably fatal until the liver-extract treatment was discovered in 1925.

An increase in the number of white corpuscles, called *leucocytosis*, usually takes place whenever infections occur in the body. This is a normal response to bacterial invasion and it helps physicians to diagnose appendicitis, tonsillitis, pneumonia, and other infectious diseases. White corpuscles multiply enormously also in a rare and dangerous disease of the bone marrow or lymph glands, called *leucemia*.

Hemophilia is an affliction in which the blood does not clot sufficiently to stop bleeding, so that minor wounds may prove fatal. It appears only in men, but is transmitted only by women. Thus the sons of a hemophilic father will be normal, but the daughters, while apparently normal, will hand on the disease to their sons.

Blood Types and Transfusions

Early experiments in replacing blood lost by one person with the blood of another sometimes succeeded perfectly and at other times proved fatal. Long investigation revealed that there are four types or groups of human blood, called for convenience A, B, AB, and O.

Between persons of the same blood type, blood can be exchanged safely. But where blood types differ, the following rules apply:

Persons of Types A or B can receive blood from those of Type O and can give blood to those of Type AB; but persons of these first two types cannot exchange blood.

Those of Type AB can receive from persons of all other types (universal receivers), but can give to none outside their own group.

Those of Type O can receive from no other groups, but can give to all others (universal donors).

The wrong type of blood entering a person's circulation immediately *agglutinates*; that is, its red corpuscles clump together, forming tiny clots which block the capillaries. This is believed to be caused by the reaction of certain complex substances in the plasma of the receiver (*agglutinins*) and corresponding substances in the red cells of the incoming blood (*agglutinogens*). The blood of universal receivers (AB type) lacks agglutinins and therefore has no effect on incoming blood. The blood of universal donors (O type) lacks agglutinogens and therefore is not affected by agglutinins in the blood of the receiver.

In giving transfusions, hospitals prefer to use blood of the same type as the patient's, but in emergencies will use blood suitable according to the foregoing rules. Blood plasma, from which all the red corpuscles

have been removed, is often adequate for transfusions, and does away with the problem of matching blood types. Whole blood for transfusion may be kept in refrigerated "blood banks" from two to three weeks; liquid plasma, for several years. Dried plasma may be kept indefinitely without refrigeration and requires only the addition of sterile water.

Measuring Blood Pressure

The measurement of the pressure of blood in the arteries is useful to doctors in making diagnoses. A flat rubber bag, called a cuff, is wrapped around the patient's arm. The cuff is inflated to an air pressure sufficient to match the pressure of blood in the large artery of the arm. The pressure is recorded on a mercury manometer connected with the cuff. Pressure exerted when the heart is contracting is the *systolic pressure*; the lower pressure, when the heart is relaxing, is the *diastolic pressure*.

The usual systolic pressure in babies and children is 75 to 90 millimeters of mercury; in young adults, 100 to 130 millimeters; and in older persons, 130 to 150 millimeters. The diastolic pressure is usually from 30 to 50 millimeters below the systolic pressure. Blood pressure shows a marked increase during periods of excitement.

How Blood Circulation Was Discovered

The ancients believed that the arteries contained air, and only the veins blood. The Greek physician Galen, in the second century A.D., demonstrated that both arteries and veins contain blood; but he thought the blood went out and back in the arteries—a kind of ebb and flow—and similarly for the veins, with a different kind of blood. A direct connection between arteries and veins was not thought of. In 1628 Dr. William Harvey, of London, published a book in which he proved that the quantity of blood leaving the heart and the rate at which it leaves made a return to the heart necessary. He did not, however, actually see the minute capillaries which connect arteries and veins. It remained for the Italian Malpighi, in 1661, and the Hollander Leeuwenhoek, in 1669, to demonstrate with the microscope the existence of these minute tubes connecting arteries and veins. If the foot of a live frog is placed under a microscope, the blood may actually be seen flowing through the capillaries which lie in the webbing between the toes.

BLOODROOT. In the warm sunlight of early spring the bloodroot bursts into wondrous loveliness, only to vanish in a day or two when the fragile white petals are swept by the spring rain or winds. While the days are still sharp and chill, it pushes its blossom above ground, wrapped in the protecting cloak of its silver-green leaves, ready to unfold with the first warm sunshine. The plant owes its name to the blood-red juice which oozes from its broken stems and roots. Perhaps grandmother may tell you that she once cured a cold or cough by eating drops of this orange-red liquid on a lump of sugar. The roots of the plant are still used at times in medicine. Long



The white flowers of the bloodroot are borne on a smooth stem 6 to 14 inches tall. The rounded leaves are deeply indented.

BLUEBELL. Countless allusions in literature to the "bluebells of Scotland" have accustomed us to think of this dainty flower as peculiar to that country, but it is no less common in North America and other parts of the Northern Hemisphere. The bell-shaped blossoms of the various species may be blue, violet, purple, or white. They hang head downward on tall, slender stems, from a few inches to several feet in height. The leaves are narrow and lancelike. Throughout Canada and the United States the flowers inhabit shaded moist areas, and they are also commonly found in mountains. They bloom from June to September.

Bluebells belong to the genus *Campanula* (Latin, meaning "little bell"), which includes about 250 species. The bluebell of Scotland is also commonly known as the harebell (*Campanula rotundifolia*). The tall bellflower (*C. americana*) is a more southerly species, found from Canada west to Iowa and south to Arkansas and Florida. The most popular garden species is the Canterbury bell (*C. medium*). In the United States the name "bluebell" is also applied to the Virginia cowslip or lungwort (*Mertensia virginica*).

BLUEBERRY. Like the cranberry, the blueberry is nature's free gift. Our chief market supply of this delicious fruit comes from extensive patches of wild bushes found in scattered areas of Canada and the United States. Attempts to cultivate the blueberry failed until scientists discovered that in its wild state it is always associated with a nitrogen-gathering fungus, which grows on its roots. This fungus thrives best in an acid soil composed of peat and sand. Most blueberries produce their fruit in clusters, but the mountain blueberry and the related plants of Europe and Asia bear the fruit singly. All cultivated blueberries are hybrids of the highbush species, developed since

ago the Indians stained their bodies with the bright dye before a war dance and used it to color the grasses and quills for their baskets. The blossoms cover open woodlands in April and May, from Canada to Florida, and west to Nebraska and Arkansas. It has from 8 to 12 large white petals, and yellow stamens. Scientific name of bloodroot, *Sanguinaria canadensis*; it belongs to the poppy family.

1906 by the experiments of Frederick V. Coville, chief botanist of the United States Department of Agriculture, and Elizabeth C. White of New Jersey. New Jersey has the largest acreage.

Six species of wild blueberries are marketed commercially. The most important is the lowbush (*Vaccinium angustifolium*), which grows from Maine to Minnesota and southward in the Alleghenies to West Virginia. The "blueberry barrens" of Maine cover an area of about 150,000 acres. The highbush blueberry (*V. corymbosum*), 10 to 15 feet in height, grows from Maine to Michigan, and south through Georgia. The dryland blueberry or "low huckleberry" (*V. pallidum*), one to two feet high, is important in northern Alabama and Georgia, Maryland, and West Virginia. The Pacific coast has the evergreen blueberry (*V. ovatum*). The branches are shipped east to be sold for decorative purposes under the name of "evergreen huckleberry." The mountain blueberry (*V. membranaceum*) grows chiefly on the high slopes of the Cascade Mountains. The rabbiteye blueberry (*V. virgatum*) is the chief commercial species of the southeastern states.

The name "huckleberry" is properly applied to the related genus *Gaylussacia*. Both are members of the heath family, *Ericaceae*. True huckleberries are more acid than blueberries and are shiny black. In Europe the blueberry *V. myrtillus* is called the bilberry or whortleberry; in America, whortleberry is another term for huckleberry.

BLUEBIRD. One of the earliest voices of the northern spring is the bluebird's. His sweet plaintive warble seems to lament the snow-sprinkled fields that often greet his return from the South. In spite of his sad little song, this brilliantly colored bird is the symbol of happiness. Like his namesake in Maeterlinck's story, he is found in common places, seeking the companionship of man in fields, orchards, and gardens.

The nest is always placed in some cavity—a hollow apple tree, abandoned woodpecker hole, rotted fence post, bird box, even in rural mailboxes. The bottom is lined with dry grasses, on which the female lays four to six bluish-white eggs. A wise farmer protects bluebirds, for their summer diet consists largely of harmful insects, grasshoppers, cutworms, and locusts. In the winter they eat wild berry seeds.

Bluebirds belong to the thrush family *Turdidae*. There are three well-known species:

Eastern or common bluebird, *Sialia sialis sialis*; 7 inches; upper parts bright blue; tipped with rust in fall; throat, breast, and sides, chestnut; female, grayish blue, under parts paler than male; young, dark gray spotted with white; range, east of Rockies, Labrador to Florida; winters from Middle States to Gulf.

State bird of New York and Missouri.

Mountain or Arctic bluebird, *Sialia currucoides*; 7¼ inches; cerulean blue; female, brownish gray with blue wings and tail; range, mountains of western North America; winters, southern U. S. and Mexico. State bird of Idaho and Nevada.

Western bluebird, *Sialia mexicana occidentalis*; 7 inches; upper parts purplish blue and chestnut, under parts chestnut; range, western Nevada and Idaho to Pacific coast, north to British Columbia; winters in Mexico.

A BLUEBIRD FAMILY



The bluebirds are devoted parents, though the father lets his mate do the work while he sings to her. The speckled breast of the baby is characteristic of all thrushes.

BLUE-FISH. A salt-water fish of blue color, two or three feet in length, highly prized as food and also as a game fish. (See Fish.)

BLUEJAY. "Thief! thief!" the bluejay shrieks, as he flies through the orchard. Uncle Remus says, "Jay-bird don't rob his own nes'," so his warning must be to the small birds he is about to molest. He is a bold and cheerful rascal, so handsome that he makes us forget his appetite for eggs and young birds. His admirers have tried to clear him of the charge of nest-robbing, but the outcry of his little neighbors when they see him near their homes is evidence against him.

Jays, a group of the crow family, are found throughout a large part of the world. They are smaller than crows and more active. Most species are brightly colored and nearly all show some shade of blue. The common jays of Europe have a body color of reddish-gray with blue and black on tail and wings.

The most showy of the family are our own bluejays. They are about 11½ inches long. Male, female, and young are alike feathered in violet-blue above, white and gray below. A showy crest of blue is outlined by a black band which extends around the neck like a collar. The wings and tail are bright azure-blue, broadly tipped with white and barred with black. Of their manner James Whitcomb Riley says—

Mr. Bluejay, full o' sass
In them baseball clothes o' his,
Sportin' 'round the orchard jis'
Like he owned the premises!

Besides his robber-cry, the bluejay has a clear musical whistle-call unlike the notes of any other bird. His nest of sticks, bark-strips, rags, paper, or any material that is handy, is built in the low branches of a bushy tree, oftenest an evergreen. There are four to six greenish-buff brown-spotted eggs. The birds feed on insects and large seeds, nuts, and some fruit.

Although in autumn there is a general migration toward the south, the bluejay is frequently found in Canada the year around, and in the United States he is a regular winter resident.

Jays belong to the family *Corvidae*, which also includes the magpies and crows. Scientific name of bluejay, *Cyanocitta cristata*.

BOA CONSTRICTOR. Often the name "boa constrictor" is loosely applied to any large serpent that crushes its prey in its powerful coils. But the name properly belongs to two snakes which are natives of tropical South America, the true boa constrictor and the anaconda. The former lives in dry bushy regions, and the latter in swampy places. The boa constrictor sometimes attains a length of 12 feet and the anaconda of 30 feet. Both are to be distinguished from the pythons, which are residents of the tropical regions of the Old World. The boas have no poison fangs, but their powers of crushing are great. They are able to swallow whole animals the size of a small dog. After feeding they remain torpid for several weeks to complete the process of

digestion and during this period they may be easily killed. (See Snakes.)

BOAR. Hunting this ferocious species of wild swine was once one of the favorite sports of kings and nobles, and a special breed of dogs (boar-hounds) was developed for it. The wild boar is larger than most breeds of the domestic hog, and its formidable tusks and savage spirit make it a dangerous foe when brought to bay. It is still preserved for hunting on some great estates in Europe. "Pig sticking," as it is called in India, is one of the most popular sports among British residents there.

This powerful beast is about four feet long and covered with bristles and grayish-black hair. The great tusks of the lower jaw in the adult curve so far over the snout as to become useless, and their place as weapons is taken by the protruding teeth of the upper jaw. The boar lives in the forest and comes forth at night to feed on roots, herbs, grains, and small animals.

Scientific name of European wild boar, *Sus scrofa*. It is found in Europe, northern Africa, and central and northern Asia, is fairly plentiful in Spain, Russia, and Germany, but is extinct in England. The Indian wild boar, *Sus cristatus*, is slightly taller than the European. The "peccary" of Texas and Mexico, a much smaller animal, was the only wild hog found in North America.

BOARDS OF TRADE. A large floor is crowded with men who are shouting, dashing here and there, and making strange signs with their fingers. Messenger boys dodge through the throng, and telegraph instruments keep up a ceaseless clatter. Such is the usual scene in one of the grain exchanges in which the nation's grain crops are marketed year after year.

A grain exchange—called "Board of Trade" in Chicago, "Chamber of Commerce" in Minneapolis, and by other names elsewhere—is a special market place. Only a member of the exchange can trade upon its floor; but anyone who wishes to buy or sell can give his order to a member, who then acts as his broker and charges a small fee, called *brokerage*, for the service.

Trading is done in different "pits" for the various grains. Deals are arranged by finger signals, one finger standing for 5,000 bushels or for one-eighth of a cent in price, according to the sign. By a few rapid gestures, a man may buy or sell perhaps half a million bushels of grain; details of the transaction are noted only by those concerned upon their own trading cards. At the close of business, the trade is faithfully fulfilled, even though somebody may have lost a fortune.

The price quotations in all leading exchanges are immediately telegraphed everywhere. If the price difference between two markets should become greater than the cost of transportation between them, traders will buy in the low-price market and at the same time sell equal quantities in the high-price one. This process, called *arbitrating*, keeps grain prices reasonably equalized all over the world, except when tariffs or other restrictions interfere.

Sales of grain for immediate delivery are called "spot sales," and the grain is "cash grain." A more

specialized activity is trading in *futures*. A "future" is a contract to accept or deliver grain during some specified month. The seller usually does not possess the grain he contracts to deliver, but expects to buy it at a lower price before the time of delivery. An example will make clear the nature and value of such trading.

Suppose that in June demand for wheat is normal, and good crops are in sight. During July, new winter wheat will enter the market (*see* Wheat); this should cause lower prices. In June, therefore, traders will sell "July wheat"—that is, agree to deliver wheat in July—for less than the June cash price. If, however, conditions indicate that prices will go up in July, traders will demand an advance upon June prices for July wheat.

A trader who buys under this arrangement is said to be "long July wheat." The seller is "short July" until he "covers his trade" by purchasing the grain. If the price goes lower, as he expects, he makes a profit; if the price goes up, he loses, since he must deliver the grain, regardless of cost. Therefore he is *speculating*, or accepting a risk in order to profit if he has judged price trends correctly.

Usually the trader furnishes a certain percentage, called *margin*, of the money required; the broker supplies the rest. If the price goes down, the broker "closes out" the trade before any of his money is lost, and the trader loses his margin money. But if the price goes up, the trader gets a large percentage of profit, since he gets the profit after having supplied only part of the money required. Traders who operate in expectation of rising prices are called *bulls*; those who expect falling prices are *bears*.

Futures contracts are paid for when they are made, not when the grain is delivered. Therefore a farmer can sell wheat and get the money, if he likes, even before the wheat is grown. Flour millers also can buy a season's supply of wheat whenever they think prices are favorable; but they benefit even more by being able to *hedge* their purchases of wheat.

Whenever a flour miller buys wheat, he hedges the purchase by selling an equal amount in the futures market. If thereafter the price goes up, he loses on his futures, or short, sale; but he gains equally from the increased value of the wheat he owns. Lower prices make his wheat worth less; but the loss is balanced by his profit from the short sale. As rapidly as the wheat is milled, he "removes his hedges" by fulfilling his futures contracts. Thus he transfers all risk of loss to the professional speculators, who make a business of assuming these risks.

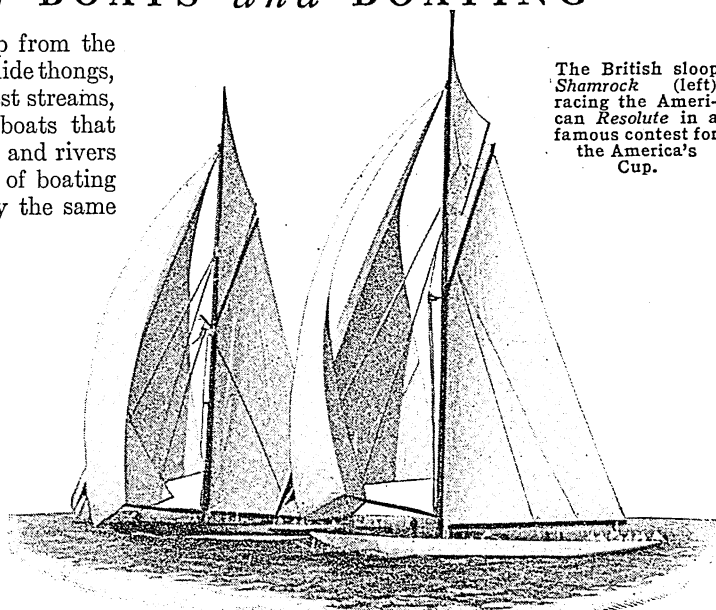
Exchanges also are maintained for spot sales and futures trading in wool, cotton, rubber, coffee, sugar, butter, eggs, silver, and other commodities. These exchanges perform useful services, but they have been subject to abuses. False prices have been established by "wash sales"—sales made by one broker to another who is acting for the same trader. Another abuse is *cornering the market*, that is, buying up all the existing supply for some contract month. Then traders who are "caught short" must pay the speculator anything he asks, to get the grain they need to fulfill their contracts. To prevent such abuses, the United States established a Commodity Exchange Administration, which had full power after September 1936 to regulate commodity exchanges, their members, and trading on margin and in futures.

The LURE of BOATS and BOATING

BOATS AND BOATING. It is a long step from the crude raft of logs tied with vines or rawhide thongs, on which our ancestors paddled across forest streams, to the finely built sailboats and motor-boats that today pass swiftly up and down our lakes and rivers and along the seacoast. But the pleasure of boating has not greatly changed. It is essentially the same now that it was thousands of years ago, when man first discovered that he could contrive a craft that would support his weight upon the water, and take him and his goods where he wanted to go.

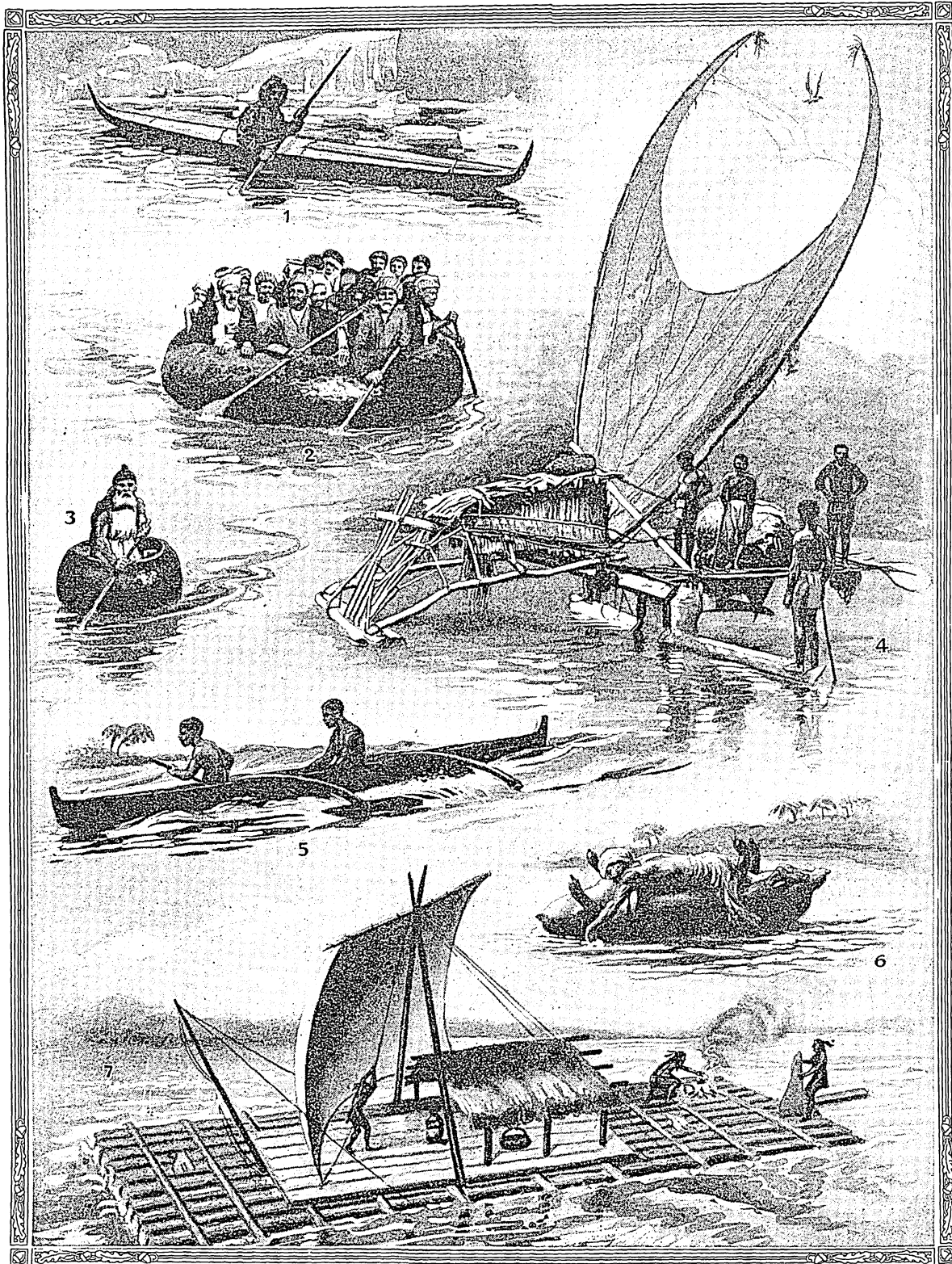
From the raft to the dugout canoe was a big step. From the dugout to the skin or bark-covered canoe was another. The greatest step was taken when man learned to harness the wind with sails.

Nobody knows when or where these first steps were taken. We only know that as far back as we can trace the story, men had boats of some sort. The first white men in America found the Indians



The British sloop *Shamrock* (left) racing the American *Resolute* in a famous contest for the America's Cup.

SOME PRIMITIVE TYPES OF WATER CRAFT



One of the most extraordinary craft ever built is the canoe (4) used in the Santa Cruz Islands, a group near the Solomon Islands. It has a long platform erected at right angles to the dugout with a living-house at the end supported by the outrigger. Other strange craft shown above are (1) an Eskimo kayak; (2) a goafah, used on the Tigris; (3) a coracle such as the early Britons used; (5) a catamaran with an outrigger; (6) an inflated bull's hide used by the natives of India for crossing rivers; (7) a balsa, or large raft, used by natives on the coasts and rivers of South America.

paddling their graceful birch-bark canoes up and down the streams. A great deal of the exploring which was done by the pioneers was accomplished by the aid of such canoes. They were so light in weight that the travelers could carry them long distances over rough trails of the wilderness while transporting in them considerable loads of provisions and equipment. (*See Canoes and Canoeing.*)

Boats differ from canoes chiefly in being propelled by oars instead of by paddles. Greater force of course can be exerted with oars than with a paddle, but the rower is at the disadvantage of having to face backward instead of forward. The types of boats for pleasure and use are legion, ranging from the long narrow racing sculls to the heavy "dories" of the North Atlantic fishermen and the life-boats of ocean liners and the life-saving service.

College Contests in Rowing

The one-man sculls are extremely light boats of a long narrow build, with sliding seats and out-rigger oars. In the four-oared and eight-oared shells such as are used by school and college crews in boat races, each man pulls a single oar. Almost all of the colleges and universities which are established near water have their four- and eight-oared crews.

The racing season is in the spring of the year. A great deal of time is spent by the candidates in training for the races, for there is probably no sport in which form and condition count more largely than they do in rowing. The person who combines strength with such a mastery of the stroke that he gets the full power of his body into each sweep of the oar is the one who usually "makes the crew."

The races between eight-oared crews are the most important events of the intercollegiate regattas. Each crew consists of eight oarsmen and a coxswain who steers. The four-mile race between Harvard and Yale on the Thames River, in Connecticut, attracts nation-wide attention each year. So does the Intercollegiate Rowing Association's four-mile race on the Hudson River at Poughkeepsie. Among the university "eights" that have competed in this event are Washington, California, Navy, Columbia, Cornell, Syracuse, Pennsylvania, Wisconsin, and Massachusetts Institute of Technology. Some of these crews have defeated Europe's finest in the Olympic Games. Certain eastern

preparatory schools also develop fine crews, which have at times defeated college crews over short distances. In recent years, a number of public high schools situated near water have taken up rowing.

Some of the girls' colleges, too, make rowing a regular part of their athletic program. Eight-oared crews are selected in competitions that are similar to the competitions for the varsity crews in the men's colleges, but the races are not such severe tests of strength and endurance. The races, moreover, usually take place between crews representing various classes within the college, rather than between crews representing different colleges.

How to Row a Boat

In the ordinary rowboat, the rower uses two oars. Rowing develops the back, leg, and arm muscles, and it is rare to find a good oarsman who does not possess an excellent chest development. The beginner at rowing is, however, likely to develop more blisters on his hands than muscles on his chest, at first. The Boy Scout manual on "Seamanship" urges the amateur to learn to row with his legs, back, and shoulders, not with his arms, and adds: "Sit square in a boat, have the stretcher as near to the body as is comfortable,

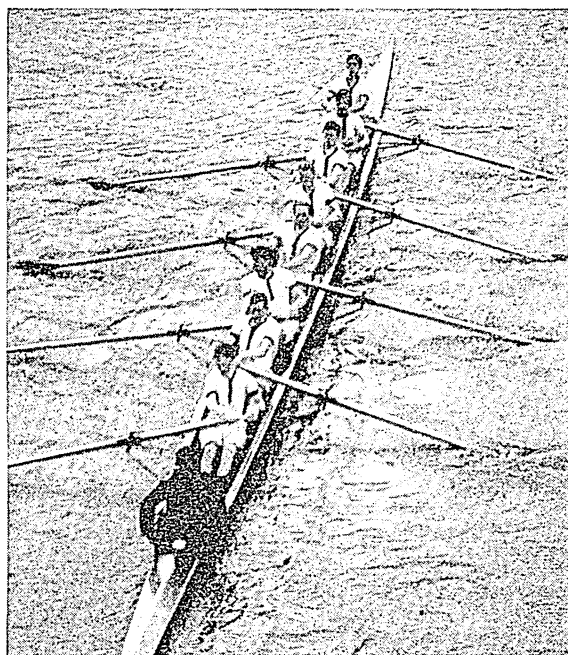
keep the heels together, feet at an angle of 45 degrees to each other, and keep the back straight. Grasp the oar with the two upper joints of the fingers, thumb underneath the oar. Grip the oar firmly, but not as if squeezing it. In making the stroke, reach well forward and pull the blade through the water with the body and legs only, the body swinging back, the legs pushing against the stretcher, and the arms kept out rigid. The blade of the oar should dip about two-thirds of its area."

At the end of the stroke, swing the arms in to the chest, bend the elbows until the roots of the thumbs touch the chest, drop the hands two or three inches to clear the oar from the water, then

turn wrists to make the feather. Be careful not to turn the wrists until the blade is clear of the water.

Sailing does not offer, perhaps, quite so much exercise as rowing, but there is no question about the fascination of the sport. Along the seacoasts and on inland waters yachting is a favorite summer pastime of many young people. Races are held for boats of various classes, with suitable trophies.

A CAMBRIDGE "EIGHT" IN ACTION



The annual boat race between Oxford and Cambridge is the big event in university athletics in England. Here a Cambridge "eight" is in the lead.

The America's Cup race has been the most famous yachting contest in the world since 1851, when the schooner-yacht *America* won the cup in a 60-mile race around the Isle of Wight. Between 1870 and 1938, American yachts won from 16 British challengers sent over to take back the trophy. Sir Thomas Lipton failed in five races with his *Shamrock* boats.

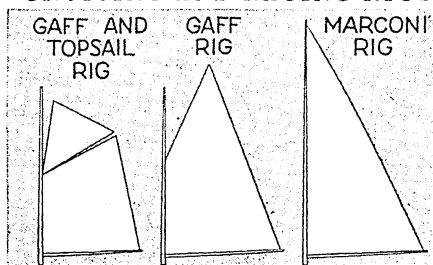
The sloop, or one-masted boat, is the favorite type for yacht racing. The catboat, the most popular craft for amateurs, is a small sloop without a jib. For cruising, yachtsmen favor two-masted craft, which may be schooners, yawls, or ketches. The drawings on this page show the rigs of these different boats.

Hulls vary with the purpose of the boat and the waters it is intended to sail. On small inland lakes, for example, a flat hull with a deep centerboard or thin keel is commonly used. On the Great Lakes and the ocean, it is necessary to have a deeper hull and a weighted keel if the ship is to be seaworthy when waves roll high. Often a motor and propeller are provided, powerful enough to drive the craft a few miles an hour in case of calm.

The most technical problem in sailing is handling the sails to take advantage of the wind. The simplest sail action occurs when a sail is spread so that it is driven square before the wind. But suppose a wind from the north is blowing upon a boat headed west.

going more than a little to the southward (the amount it does go is called "leeway"); but the water offers but little resistance to westward movement, so the boat slips along readily in that direction. The exact set of sail and rudder needed to accomplish this movement will vary with the design of the vessel and other factors. Common applications of this principle to sailing, and some of the technical terms used, are given in the accompanying diagram.

CRUISING AND RACING RIGS



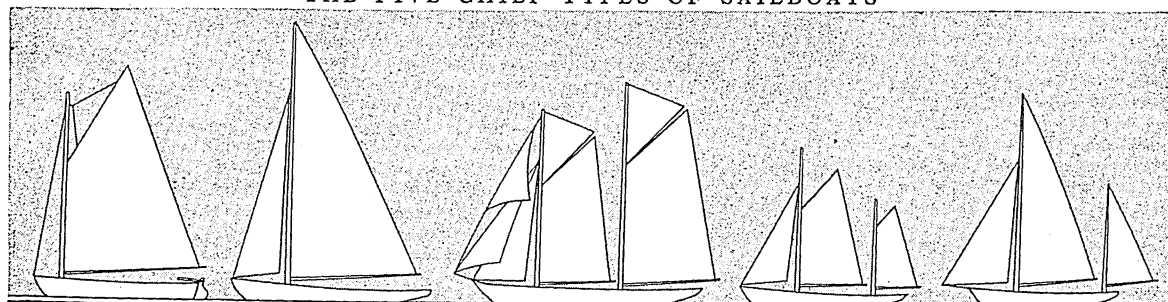
Each of these rigs has the same area of sail. The gaff-and-topsail rig is the steadiest; the Marconi, with its high reach, is best for racing; the gaff rig is a happy medium. As the drawings indicate, the "gaff" is the spar at the top of the mainsail.

The handling of sails may be understood from considering the "leg-o'-mutton," or triangular, sail used on many sloops. The vertical forward edge of the sail is fastened to hoops, which slide up the mast as the tip is drawn upward by a halyard. The bottom edge is fastened to a boom, or horizontal spar, so attached at its forward end that it can swing from side to side about the mast, swinging the sail with it, much as a door turns on its hinges. The other end is fastened

by block and tackle to a convenient mounting on the deck, so it can be let out ("paid out") to either side, or hauled close in to the center line, as the yachtsman desires. A jib (the triangular sail before the mast), is handled similarly, save that it has no boom, and the hoops on which it runs are mounted on the forestay, the cable from the tip of the mast to the bow.

Every large sail bears on each side one or more horizontal rows of short lengths of cord, called "reef

THE FIVE CHIEF TYPES OF SAILBOATS



CATBOAT

SLOOP

SCHOONER

KETCH

YAWL

The absence of a jib distinguishes the catboat from the sloop; the schooner has two or more masts, with the forward rig smaller than the aft; the ketch and yawl reverse this order, the latter carrying its smaller rig (jigger) aft of the rudder post, the former forward of the post. The sails of any of these craft may be, according to taste, of the gaff or Marconi shape.

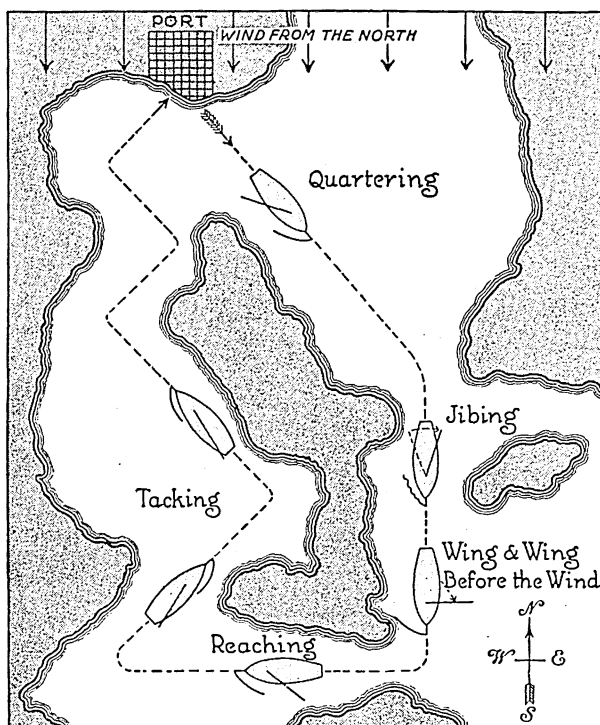
If the boat's sail were in line with the hull, so that everything was "broadside on" to the wind, the wind would press the boat and sail sidewise to the southward. To sail westward, the sail must be set to extend approximately southeastward from the mast. The wind now will exert a glancing pressure upon the sail, tending to force it southwestward. This southwestward pressure can be considered as operating in two directions—southward with the wind, and westward, the direction in which the boat is headed. Water resistance against the side of the hull keeps the boat from

points." If, owing to high wind, the yachtsman does not want to hoist his entire sail, he hoists as much as desired, then by tying reef points from each side firmly under the boom, he lashes down the unexposed portion of the sail. Because the sails of "square-rigged" ships were attached to spars high above deck, the crew had to go aloft to reef sail, instead of being able to do so from the deck, as they can on craft with "fore-and-aft" rig. (See Ships.)

In recent years gasoline motorboats have won ever increasing favor. While they do not offer the challenge

SAILING WITH, ACROSS, AND AGAINST THE WIND

AS an example of sailing with fore-and-aft rig, let us follow this sloop as she goes from her home port (at the top of the picture) around the island and returns home. With this rig the mainsail tends to turn the bow around and into the wind; and good sailing is largely a matter of using the jib to counteract this tendency, as we shall see. At first the sloop *quarters*, or takes the wind from between abaft and abeam. It also *stands on the port tack*—that is, takes the wind over the port, or left, side. The mainsail is set as explained in the text, and the jib is slacked off enough to keep the bow from turning. When he has to turn due south, the yachtsman *jibes* the mainsail, or hauls it across from starboard to port, and slacks off the jib to starboard. Now the sloop is sailing wing-and-wing before the wind. On large yachts a parachute-like spinnaker may replace the jib in this situation. When the time comes to sail west, the yachtsman puts the sloop on the starboard tack by hauling in somewhat on the mainsail and throwing the jib over to port.



Now the sloop is *reaching* on a beam wind. Finally the yachtsman must head north against the wind. This is called *beating to windward*. He decides to *come about* and head nearly northeast for his first beat or *tack*. He does so by *luffing*, or steering into the wind, and holding the rudder over until the sloop's momentum carries the bow through the wind. As the bow starts to *fall off*, or turn with the wind, the sails fill on the port tack. Now the yachtsman may close-haul his sails to head as nearly into the wind as he can without *putting the sloop in stays*, or causing it to be taken aback by the wind. But such sailing is slow; so the yachtsman will sail more nearly across the wind to gain speed. His skill and the shape

of the sloop's hull will determine where to strike the balance between gaining speed and making northward progress. In time, to avoid *overstanding*, or going too far east, he will come about on the other tack. By repeating again and again this zigzag maneuver, called *tacking*, he finally reaches his home anchorage.

to skill presented by a sailing vessel, they are less dependent upon weather, and easier to handle on narrow waters, such as rivers. They range in size from launches no larger than a rowboat to palatial yachts (usually driven by Diesel engines) able to accommodate scores of people on a transatlantic voyage. (See Gas Engine; Motor Boats.)

Such boats are classified broadly according to the type of hull and the engine location. The traditional hull is the "displacement" type, which has a prow that cuts through the water, and always sits low enough to displace its own weight. For achieving high speed on relatively calm water, the "hydroplane" hull is widely used. The hull is flat-bottomed, with or without "steps." At high speed the forward portion rises clear of the water, and the craft skims over the surface, riding on the "heel" of the hull. Owing to the ease with which it capsizes, only skilled drivers can handle this type of vessel at high speeds.

Motor boats are further classified as "inboard" or "outboard." An inboard boat has the engine inside the hull, connected by a shaft to the propeller. An "outboard" has the engine and propeller in one unit, hung overside from the stern, leaving the interior of

the craft free for the occupants. Rowboats can be made into motor boats by attaching an outboard motor, and can be used in extremely shallow water, since the engine is pivoted on its mounting and can be swung up to clear obstructions. Outboard motors are suited only to smaller craft. Larger ones must have their motors mounted further forward, not only because of the greater weight but also because the powerful action of the propeller has a tendency to force the stern of the boat down into the water.

Ancestors of Modern Craft

One of the most curious of primitive boats was the round "coracle," which Caesar found in use when the Romans invaded Britain, and which is still used in certain lakes of Ireland and by Welsh fishermen. It is an open saucer-shaped vessel, usually large enough for one man only. A skin or other waterproof covering is stretched and fastened over a frame made of thin strips of wood laid across one another, tied together, and bent upward.

A boat similar to the coracle is the "goofah," a circular, basket-like craft woven of willow twigs and smeared with bitumen, in which, some say, Moses was set adrift. It is still used on the Tigris and Euphrates.

The round, clumsy-looking "bullboat" of the Sioux Indians was also of this type. It was built by stretching a buffalo hide over a framework of saplings and boughs. After it had done its work of carrying the Plains Indians and their belongings across a stream, the buffalo hide was frequently pulled off the frame and used as a container for utensils to be carried on a travois for overland transportation.

Catamarans and Proas

Off the coast of India and elsewhere, natives use a primitive craft, called a "catamaran," made of three logs lashed together. The middle log is longer than the other two and is pointed to form the prow. The rower kneels on this middle log and propels the boat with a paddle. This simple catamaran will safely ride the roughest seas. Another form of catamaran is that shown in the picture on page 162. It is a swift canoe with an outrigger attached to one side to prevent capsizing. This outrigger, as the picture shows, is formed of two spars, to the ends of which is attached a boat-shaped floating spar.

Among the best of primitive boats is the Malay *proa*, or *prau*. It has a sail to make it swift and an outrigger to make it safe. A typical proa is a long narrow canoe, pointed at both ends so that it can reverse its direction without turning. One of its sides is flat; the other, curved. From the curved side projects the outrigger. The lateen sail, triangular in shape, is supported by a mast that rises from a point midway between the ends of the boat. It was in these swift proas that Malay pirates used to dart out from inlets and attack passing ships. (A list of sailing terms will be found with the entry Navigation, in the Fact-Index.)

BOBOLINK. The bobolink leads a double life. In the South it is known as a bold robber that destroys rice crops. In the North it is one of the most beautiful singers and is welcomed because it eats insect pests and weed seeds. One of the joys of spring and early summer is a clover field fairly bubbling with bobolinks. As they restlessly flutter up from the ground, sail to a near-by clover top, settle down a moment with quivering wings, then disappear into the grasses again, they are constantly singing the rollicking song that gives them their name. The black underparts and white and buff backs are conspicuous marks by which they may be easily identified (for illustration in colors, see Birds).

Their simple nest of grasses and dried weed stems

lies in a slight depression on the ground. The birds take great care not to reveal its location. The male never sings near it, and both parents leave and approach it cautiously, never alighting on it or taking flight directly from it. The four to seven eggs are grayish with splotches of brown or purple.

By July the bobolink begins to lose his good character. The male falls silent except for a single call note, and exchanges his striking plumage for the sparrow-like costume of his mate. In August or September the bobolinks start south in great flocks, stopping on the long journey to eastern South America to raid rice fields in the southern states. There they

are known as ricebirds, reedbirds, or ortolans, and so costly are their raids that they may be shot on sight.

A Queer Migration Route

One of the most interesting things about the bobolink is its migration route. Originally a bird of eastern North America, it followed man westward as grain fields sprang up on plains and cleared forest lands. Today it is found as far west as the Rocky Mountains. But whether it summers in Utah, British Columbia, or Massachusetts, it always journeys to Brazil by way of Florida.

Although the route from the western states straight south over Mexico would be much shorter, these birds go east first, retracing the path by which their ancestors extended their range, until they reach the traditional southern route.

The bobolink belongs to the family *Icteridae*, which includes blackbirds, orioles, and meadow larks. Scientific name *Dolichonyx oryzivorus*. Adult male, 7 inches; in summer, underbody, face, and top of head, black; back of head and upper back, buff; lower back, upper tail and wing coverts, grayish white. Female and young, sparrow-like.

BOER WAR. On Oct. 11, 1899, war broke out in South Africa between the independent Boer republics of the Transvaal and the Orange Free State on the one side, and the British Empire on the other. Only after three years of the hardest fighting were the British able to conquer their sturdy backwoods opponents.

The Boers were descendants of Dutch colonists in Cape Colony who had "trekked" northward in 1836 and the following years, to escape British rule after Cape Colony passed into British hands. A conflict with the Transvaal Boers had occurred in 1881, in which the British suffered a defeat at Majuba Hill; this was followed by treaties (1881 and 1884)

SOLOIST OF THE FIELDS



The male Bobolink in his beautiful mating costume of black and white sings from his perch on a weed to his quiet little brown wife. Bryant, Lowell, and many other poets have been inspired to verse by the Bobolink's liquid song and cheery gladness.

in which it was agreed that the Transvaal should have complete self-government in internal affairs, though in external affairs it should be under the suzerainty of Great Britain.

Then in 1885 came the discovery of rich gold mines in the Transvaal, and a flood of foreign and British adventurers poured in. The Boers remained chiefly rude farmers and stock-raisers, and friction with the *uitlanders* ("outlanders") followed. An ill-advised raid by Dr. Leander S. Jameson (in December 1895), to aid the *uitlanders* against the oppressive measures of President Paul Kruger only made matters worse. A birthday cablegram from the German kaiser to President Kruger led the Boers to believe that they might count on German assistance, and in 1899 war ended the long-drawn-out negotiations. The Orange Free State joined the Transvaal in arms, and many liberals throughout the world sympathized with the Boers' fight for independence.

The vigor of the Boers and the distance of the conflict from Europe taxed the resources of Great Britain as they had never been taxed since the days of Napoleon. Her foes were trained to the use of weapons since boyhood, and fought in a country where they knew every pass and "kopje" (hill). There were no great battles, and the war was mainly a series of ambushes, traps, and sieges—of Ladysmith, Mafeking, and Kimberley especially. For the British, Lords Roberts and Kitchener were eventually put in chief command, while the Boers fought under generals Christian de Wet, Louis Botha, Joubert, and Delarey.

Excellent marksmen and horsemen though they were, the Boers were unable to resist the stream of men that Great Britain poured into the war. On Feb. 27, 1900, General Cronje, one of the Boer leaders, surrendered with 4,000 men. On March 13 Lord Roberts entered Bloemfontein. On May 1 the advance began on Pretoria, the Boer capital. At Spitzkop, on September 8, General Botha fought the last set battle of the war.

From that time until the war's actual end, the Boers led by De Wet, Smuts, and others harassed the British with guerilla tactics. Because of the obstacles placed in the British path by the non-combatant population, concentration camps were established where the high rate of mortality among women and children prisoners aroused world-wide criticism.

By the treaty of Pretoria (May 30, 1902), which ended the struggle, the Transvaal and Orange Free State became British colonies. But self-government was soon restored, and in 1909 these former enemy countries became equal members with Cape Colony and Natal in the South African Union, and Gen. Louis Botha—the former Boer leader—became the first prime minister (see Botha). The British had employed 450,000 men in the war, losing 1,100 officers and 22,800 men killed, wounded, or missing, and 43,616 sent home as invalids. The total Boer force was about 95,000. (See Rhodes, Cecil; South Africa.)

BOHEMIA. Encircled by mountains and highlands, picturesque Bohemia lies very nearly at the center of Europe. In early times this fertile land was inhabited by the Boii, a people of unknown origin. Thus it came to be called Bohemia, which means "home of the Boii." Early in the Christian era it was occupied by a Slavic people called Czechs. From their name it came to be called Čechy (*chĕk'z*).

Mountain chains—the Bohemian Forest, the Ore Mountains, and the Sudetes—on three sides and the Moravian hills on the fourth have kept the Czechs together and enabled them to maintain their Slavonic language and their racial unity. But its hills and mountains have not protected the little land from frequent invasion and conquest.

Under strong kings, Bohemia's boundaries expanded in the early Middle Ages to include the closely related region of Moravia, parts of Poland, and Slovakia. Bohemian kings were among the seven electors of the Holy Roman Empire, and some of them became emperors. The Hussite wars of the 15th century (see Huss, John) left the power of the kingdom greatly impaired, and in 1526 it became a Hapsburg possession, ruled from Vienna. The Thirty Years' War, beginning in 1618 with a Protestant revolt in Bohemia, left the land wasted and Protestantism crushed.

For three centuries thereafter the Bohemians clung to the hope of again becoming independent. This hope was realized after the first World War when the Treaty of Versailles freed them from Austrian rule and made them the masters of the new state of Czechoslovakia. After 20 years of freedom, the territory once again fell under foreign rule. By the Munich Pact of 1938 the Sudeten area was incorporated in Germany proper, and in 1939 the remainder of Bohemia became part of the German protectorate of Bohemia and Moravia (see Czechoslovakia). The old boundaries of Bohemia included an area of approximately 20,000 square miles and a population of about 7,000,000.

The French mistakenly called the roving bands of gipsies who appeared in central Europe in the 15th century "Bohemians," and later transferred the name to the type of roving, carefree artist who leads an unconventional life. But these artistic "bohemians" little resemble the hard-working peasants and artisans who inhabit Bohemia.

BOLEYN (*būl'ēn*), ANNE (1507–1536). The second queen of Henry VIII of England, Anne Boleyn, lived gaily and met death bravely. She was the daughter of Sir Thomas Boleyn and was educated at the French court. When she became lady-in-waiting to Henry's first wife, Catherine of Aragon, Anne soon captured the monarch's attention. He divorced Catherine and married Anne, hoping that she would give him a male heir. Anne's sudden rise to power made her so haughty and arrogant that she had few friends. Henry soon turned from her to Jane Seymour, who was to become his third wife. Anne was convicted of unfaithfulness and was beheaded. Her only child, then two years old, later became the great Queen Elizabeth.

BOLIVAR, SIMON (1783–1830). "The Washington of South America" and "the Liberator" are the

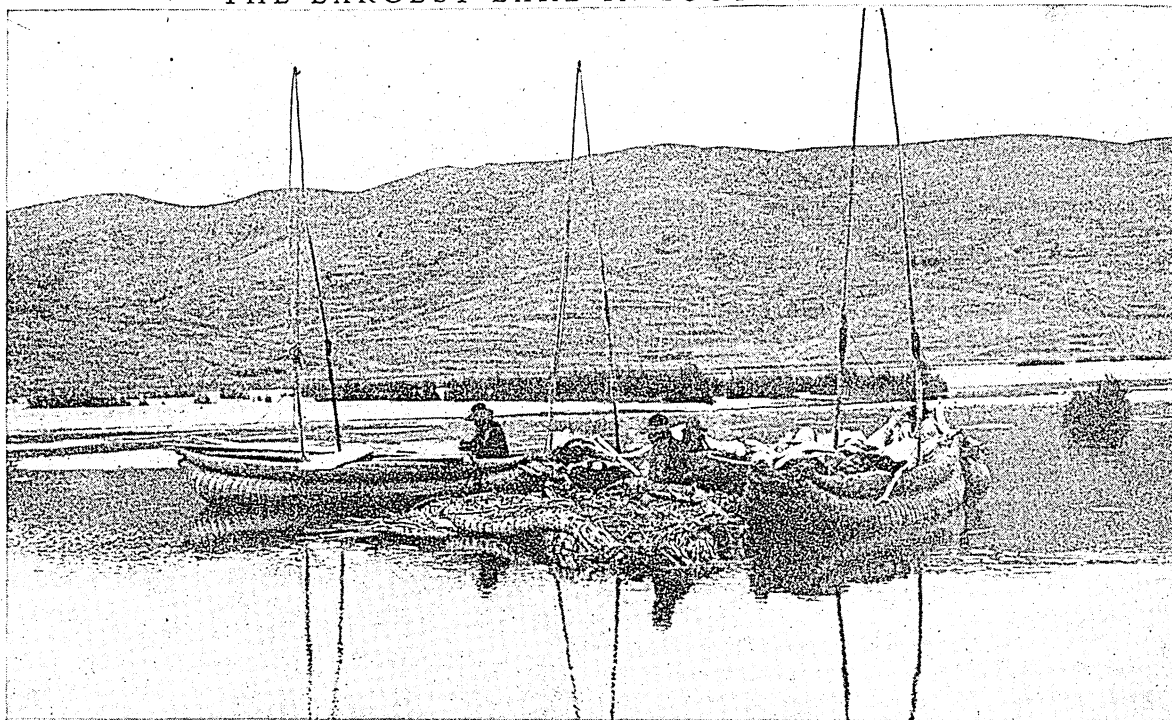
titles given this great South American statesman and general, because it was he who organized and led the revolutions which, after 300 years of misrule, freed Venezuela, Colombia, Peru, and Bolivia from the power of Spain. Born in Caracas (now the capital of Venezuela) of a noble and wealthy Spanish colonial family, he was studying law in Madrid when Napoleon overran Spain and temporarily broke her power. All Spanish America realized the opportunity to emulate the United States of the North and struck for freedom.

Hastening home, Bolivar put himself at the head of the patriots of Venezuela. The successful insurrection in Caracas, in April 1810, was followed within

spirit Bolivar resigned his offices in 1829 and retired to Cartagena (Colombia). He died the next year, at the early age of 47 years. Not until long after his death were his character and services truly estimated.

Obliged for a time to assume dictatorial powers, Bolivar was a sincere patriot, devoted to the cause of liberty and equality. His private fortune and the large sums voted to him were spent for military supplies and in the liberation of slaves. President Monroe trusted him and gave him timely aid by recognizing the new republic, and announcing the "Monroe Doctrine," which notified European governments to keep hands off. Bolivar was buried in

THE LARGEST LAKE IN SOUTH AMERICA



Situated on a plateau in the Andes Mountains, more than 12,500 feet above sea level, Lake Titicaca is the highest of the world's big navigable lakes. It is about 130 miles long and averages 30 miles in width. As there is no wood thereabouts, the natives weave boats from reeds. These boats are substantially made and carry merchandise and fish to the settlements along the shore;

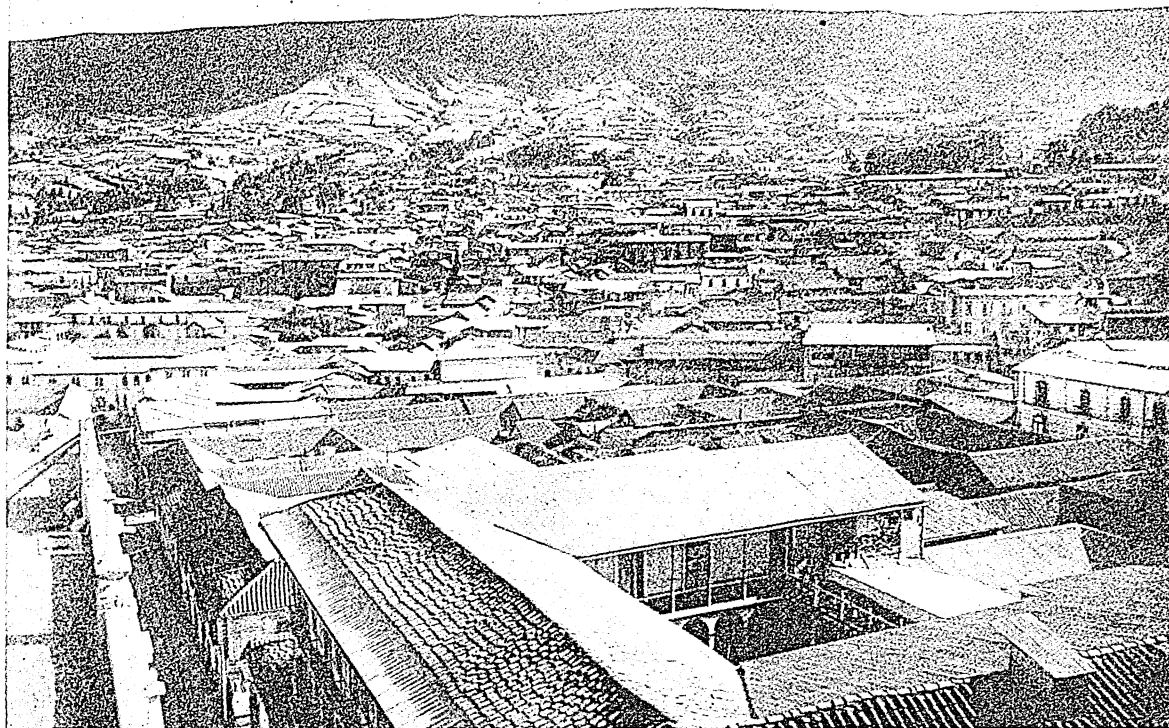
a month by rebellion in Argentina and Chile. Soon the continent boiled into revolution. For the next 20 years Bolivar led a life of romantic adventure. Between victories and disastrous campaigns, he was alternately the conquering hero with an army and autocratic power, and a deserted fugitive pursued to the West Indies by hired assassins. He reached the pinnacle of his glory in 1828, when he was president of three countries which he had liberated: the republics of Colombia (then comprising Venezuela, Colombia, Panama, and Ecuador), of Peru, and of Bolivia—the latter formed from southeastern Peru and named in Bolivar's honor.

The spirit of disunion and opposition, however, was strong, and in broken health and bitterness of

Caracas, where the centennial of his birth saw a triumphal arch erected to his memory.

BOLIVIA. Landlocked in the heart of South America, Bolivia is entirely surrounded by its neighbors—Brazil, Paraguay, Argentina, Chile, and Peru. A war with Chile stripped Bolivia of its Pacific seaboard in 1883. A war with Paraguay was followed by an agreement in 1938 giving Bolivia a gateway to the Atlantic through the Paraguay River. But the effect of these wars was to leave Bolivia one of the poorest and most sparsely populated countries in the continent. Its area of about 420,000 square miles is almost twice that of France; yet its population, of which no census has been taken for more than a generation, is estimated at only three million.

LA PAZ, THE CAPITAL ON THE ROOF OF BOLIVIA



Twelve thousand feet above sea level—a height so great that the visitor finds even walking hard work—stands La Paz, the world's highest capital. Frowning mountain walls a thousand feet high encircle it, and far above it tower the white slopes of Illimani, one of the giants of the Andes. Although it is in the tropics, La Paz lies at such a height that the cold at night is often intense. The barren grandeur of the surrounding mountains, the dazzling sunshine, and the brilliant colors of the houses make a sight such as can be seen nowhere else in the world.

The heart of Bolivia, both geographically and economically, is the Bolivian plateau (altiplano), a great tableland at "the top of the world." It is 500 miles long and lies at an average altitude of 12,000 feet above sea level, between two ranges of the Andes Mountains (for map, see Brazil). Although Bolivia is in the torrid zone, the plateau, because of its height, has a comparatively cold climate. The land is arid and supports only a few hardy crops, such as the potato. Most of the population, which averages only about six persons to the square mile, is concentrated on the plateau and in the adjacent highlands.

Potosi, center of Bolivia's greatest silver and tin mines, is the highest town in the world (14,350 feet above sea level). Sucre is the nominal capital, but the actual seat of government is La Paz, largest city of Bolivia. La Paz is on the Bolivian plateau, and so its average temperature is only 50 degrees. At these heights there is no coal or timber, and house-heating is rare. The chief fuels are llama manure, peat, and *yareta*, a large, woody rooted plant.

Lake Titicaca, a great inland sea about half the size of Lake Erie, lies partly within Peru and partly within Bolivia. It is the largest lake of South America,

and one of the loftiest in the world, with an elevation of more than 12,500 feet. Its intensely cold waters are often swept by furious gales. Steamer service connects Bolivia and Peru. Not far from the Bolivian end of the lake lie the vast ruins of Tiahuanaco, the work of a mysterious Indian race of unknown antiquity, antedating by centuries the Inca civilization (see Incas).

On the eastern slope of the Andes the river valleys fall away in beautiful fertile slopes. Between 9,000 and 5,500 feet the temperature is delightfully mild and the vegetation is varied and abundant. Below 5,500 feet great undulating plains stretch east and northeast to the borders of Brazil, and southeast to Argentina and Paraguay. Here lie trackless swamps, vast grassy pasture-lands, and dense virgin forests. In the valleys, known as *yungas*, and in the lowlands the climate is sub-tropical and tropical. The soil is amazingly fertile, and with the development of transportation and increase in population, these regions, which comprise about three-fifths of the country, can be made one of the garden spots of the world. Here are grown Bolivia's principal crops—sugar cane, coffee, cacao, corn, wheat, beans, rice, and fruits.

The northeastern rim is a swampy, forested lowland, known as the *llanos*. This region contains extensive rubber forests, which formerly provided a large share of the country's exports. Now the competition of plantation rubber from the Far East has reduced Bolivian production to an inconsiderable amount.

Mines, Transportation, and People

Ever since the Spanish conquerors discovered immensely rich gold and silver mines in the Bolivian Andes, the mines have been the mainstay of Bolivia's economic system. Today mining is the country's major industry, the source of nine-tenths of its export trade, and the chief support of most of the people. Not gold and silver, but tin, buried in the eastern ranges of the Andes, is now the most important mineral. Bolivia produces a considerable share of the world's supply of tin. It also has valuable deposits of silver, lead, wolfram (tungsten ore), zinc, copper, and many other metals. Petroleum deposits have been found in the eastern plains, but the wells, which are owned by the government, do not yet produce enough to supply domestic needs.

As a country without a coast line, Bolivia's major transport problem has been to find access to the sea for its products. Three railroads link the rich mines of the western plateau to the Pacific, and a fourth line, connected with the railway system of Argentina, provides an outlet to the Atlantic at Buenos Aires. Almost all the approximately 1,400 miles of railroads are concentrated in the western highlands. In the eastern lowlands, the many navigable rivers are the chief means of transport. There are about 6,000 miles of roads, but few of them are good enough for motor traffic. In much of the country mules and llamas still carry most of the commodities of trade over dusty trails. Airlines are now an important means of communication, with about 3,500 miles of air routes linking the principal cities.

More than 50 per cent of the people are pure Indian; about 15 per cent are white; and the *cholos*, of mixed Indian and white blood, make up most of the remainder. The western highlands, covering only a fifth of the country's area, contain about four-fifths of the population. The rest are scattered for the most part over the tropical plains to the east. It is estimated that three-fourths of the people cannot read or write, but the government is constantly increasing educational facilities. The Catholic church is the established religion, supported by the state.

History

Bolivia was first visited by Europeans in the first half of the 16th century. For three centuries thereafter Bolivia, forming part of the vice-royalty of Peru and later of Buenos Aires, was under Spanish rule. But in 1825, after years of continual insurrection, the Bolivians finally gained their freedom. They named their country in honor of Gen. Simon Bolivar, the great South American liberator, who drafted the republic's first constitution. In the century that followed, Bolivia was racked by countless military

revolts, by the rule of reckless dictators, and by two wars. The war with Chile (1879-83) cost Bolivia its Pacific coast. In the war with Paraguay (1932-35), Bolivia lost most of the disputed Chaco region, but gained an outlet to the sea through the Paraguay River (see Paraguay). A coup d'état in 1937 brought to power a group of army officers who in 1939 restored the country to semiconstitutional rule.

BOLOGNA (*bō-lōn'yā*), ITALY. Few European cities present as vividly as Bologna the contrast between picturesque medieval days and the busy commercial life of modern times. Lying in a fertile plain at the base of the Apennines, it is the center of a railway network roughly following the course of the ancient roads from Florence, Milan, Genoa, and Venice.

The arcaded streets of the old city, laid out by the Romans in the 2d century B.C., are now lined with busy shops and echo to the clang of streetcars. Medieval churches and palaces overlook modern theaters and office buildings. In the shadow of ancient fortresses are factories, turning out silk and linen goods, glass, leather, and other products.

Bologna has 130 churches, many of which date back to the 11th and 12th centuries. Two of the most famous are the massive Gothic church of San Petronio, the city's patron saint, and the church of San Domenico, where lies the founder of the Dominican order of friars. Bologna also boasts one of the important art collections of Europe.

The University of Bologna, which was chartered in 1158, is probably the oldest existing university in Europe. It began as a law school, but soon expanded to include faculties of arts and sciences, and by about 1200 it had 10,000 pupils. It was here that Luigi Galvani discovered galvanic electricity.

Bologna was incorporated in the Papal States in 1506 by Pope Julius II. In 1860 it became part of the Kingdom of Italy. Population, about 270,000.

BOL'SHEVISM. The doctrines professed by the radical wing of the Russian Social Democratic party became known after 1903 as Bolshevism. The term arose during a meeting of the party that year, when the radicals, led by Nikolai Lenin, secured a majority of the votes. Thereafter Lenin's faction was called the "Bolsheviks" or "Bolshevists" (from the Russian word *bolshinstvo*, meaning "majority"), and the opposition group became the "Mensheviks" (from *menshinstvo*, meaning "minority").

Though both the Bolsheviks and the Mensheviks were followers of the Marxian doctrines of communism, they differed in their programs for overthrowing the czarist régime and establishing communism in Russia. The Bolsheviks believed that the party must be composed of a unified group of professional revolutionaries, that it must not compromise with liberal parties or the existing government, and that, upon achieving power by armed insurrection, it must establish a workers' and peasants' dictatorship.

In November 1917 the Bolsheviks overthrew the moderate provisional government and secured power

for themselves. Their party, now known as the Communist party of the Soviet Union, is the only legal political party in the country. Among its some two million members are included most of the high officials of government and industry, and in practise the party formulates most of the country's policies. After the death of Lenin in 1924, Joseph Stalin, as general secretary of the party, became dictator of the country. To meet changing conditions, Stalin made considerable changes in Bolshevik doctrine, and those who disagreed, including many of the old Bolsheviks such as Leon Trotsky, were exiled or executed. (See Lenin, Nikolai; Russia; Socialism; Communism; Stalin, Joseph V.; Trotsky, Leon.)

BOMBAY (*bōm-bā'*), INDIA. The city of Bombay is "the gateway to India." Its harbor on the western coast of India is one of the finest natural shelters in the world and is only rivaled in beauty by the harbors of Naples, Rio Janeiro, and San Francisco. The city itself is on an island 11 miles long and 3 miles broad, but causeways and breakwaters connect the island with the mainland so that it is practically a peninsula. Along the coast-line to the southward a range of mountains, the Western Ghats ("stepping stones") look down on the city.

Bombay was a Portuguese settlement (1534), but came to the English in 1661 as part of the dowry of the Portuguese wife of Charles II. It is the capital of the Bombay Presidency, one of the largest administrative divisions of British India. The name comes from Bambai Mumba, a Hindu goddess.

The city is today the second largest in India, owing to its position on the European trade route to the East. The opening of the Suez Canal increased its prosperity and importance. It is the terminus of important railways, and its mills for cotton cloth, developed during the last half-century, have made Bombay a great manufacturing center.

Bombay boasts many of the finest buildings in India, both public and private, including the finest and largest hotel modeled on the American plan. The university is one of the oldest in India, and the city is a great educational center. Bombay is the headquarters of the British East India fleet, and to her docks come the largest ocean steamers from all parts of the world. In the bazaars are found representatives of not only every race in India but of every type of Asiatic and European.

The main European quarter is the old district known as the Fort, though there are many pleasant hilly sections overlooking the sea that are full of handsome modern villas. On one of these desirable sites, Malabar Hill, are the old Towers of Silence, where the Parsees deposit their dead to be devoured by vultures. The Parsees are descendants of a body of followers of the ancient Zoroastrian religion who fled from Persia to India about the 8th century because of Mohammedan persecution. Though they number less than 100,000, they are the richest and most influential group in the large native community,

many of their millionaires rivaling our own in wealth and public spirit. Population of the city, about 1,160,000.

BONAPARTE. What other household has numbered among its sons and daughters so many kings and queens as did the famous Corsican family of Bonaparte, whose Italian origin is shown by the original spelling of their name, "Buonaparte"?

The characteristics which made members of this family, in the early 19th century, rulers of a great part of Europe were probably inherited from their strong-willed mother. Her husband was a lazy, pleasure-loving, impractical man, who afforded her little aid in the rearing of their eight children, and who died in 1785. But she, according to her famous son Napoleon I (see Napoleon I), possessed "a man's head on a woman's body." She was endowed with good health, ceaseless energy, and a strong will, and these characteristics were manifested strikingly in the military genius of her second son. She lived to witness his glory and his fall, and even survived him by 16 years. But she never fitted into the altered family fortunes. Though given immense wealth and the title Madame Mère (Mother), she lived in such retirement and strict economy as to make her unpopular in France. Her last days were spent in Rome, whence she wrote a pathetic letter to the rulers of Europe begging for her son Napoleon's release from captivity. She died in 1836, after being almost blind for some years.

A Family of Kings and Queens

The eldest of her family, Joseph (1768-1844), was a man of culture and talent whose chief bent was towards literature. When he was made king of Naples by his brother Napoleon, Joseph introduced many much-needed reforms in that land. His troubles began when his imperious brother took the throne of Naples from him and gave him that of Spain. Joseph was unable to suppress the rebels of that kingdom, and was driven from his throne in 1813. After the battle of Waterloo, with the crash of the family fortunes, he found a place of refuge in America, and resided in Bordentown, N. J., for some time. He died in Florence, Italy, in 1844.

Unlike Joseph, who was exceedingly anxious for power, Napoleon's second brother, Lucien (1775-1840), was an ardent republican, took little interest in his brother's conquests, and often quarreled with him. He never ruled a kingdom, although he held from the pope the title of Prince of Canino. He died in Rome in 1840.

Next to Napoleon I, Louis Bonaparte (1778-1846) ranks in interest in this royal family. He was king of Holland by gift of his great brother, and was father of Napoleon III (see Napoleon III), second emperor of the French. When King Louis could not rule his country in the interests of its people he resigned his throne in 1810 and retired to Italy. A sentimental interest also attaches to Louis as the husband of Hortense, daughter of the Empress Josephine.

A kindly and sensitive nature, he was noted in his after-life for his philanthropy.

The youngest son of this illustrious family was Jerome (1784-1860), at one time king of Westphalia, a kingdom created by Napoleon in eastern Germany. Before attaining this royal dignity, Jerome had been in service in the French navy, and on one expedition had taken refuge from his English pursuers in the United States. While in this country he married Elizabeth Patterson of Baltimore, in spite of Napoleon's protests. The marriage was soon annulled by order of his imperial brother, and Jerome married a German princess; but from the first alliance sprang a prominent Baltimore family whose best-known member, Charles Joseph Bonaparte, was secretary of war and later attorney general of the United States in President Theodore Roosevelt's cabinet.

Napoleon's Sisters and What Became of Them

There were, besides the five boys, three girls in the family—Elisa, Marie Pauline, and Caroline—all of whom shared in their brother's glory. Caroline, who was married to Napoleon's general, Murat, even attained to the dignity of queen of Naples, for Murat was given that throne by Napoleon when Joseph Bonaparte was transferred to Spain. When her husband was shot, following the final fall of the Bonapartes, Caroline retired to Trieste, in Austrian territory, where she died in 1839. Elisa (1777-1820) married a Corsican who was made grand duke of Tuscany.

Pauline (1780-1825), the gayest and most beautiful of the girls of the family, was long a thorn in the flesh to her imperial brother. She was married to Prince Borghese in Italy, but when Napoleon was removed to Elba, in 1814, she and her mother joined him there. She is even said to have expressed a desire to share his exile to St. Helena, when Napoleon was sent to that remote island following the failure at Waterloo of his attempt to recover his lost power. She died of cancer in 1825. (*See also* Napoleon I; Napoleon III.)

BONDS. When a corporation or a government borrows money, it usually issues written or printed promises under seal to repay it at the end of a stated period, and to pay in the meantime a specified rate of interest per year. Such an evidence of debt is called a bond. (*See* Stocks and Bonds.) The word comes from the verb "to bind," and is used in other senses also—as "bail bonds" (security to appear for trial); "surety bonds" (given by officials who handle money as a guarantee of their honesty); "bonded warehouses" (government warehouse where imported goods or alcoholic liquors are placed pending payment of revenue taxes).

BONE. The hard tissue of which animal skeletons are made is called bone. It is heavier than water and varies from a grayish white to a pinkish color. It is composed of two classes of substances. One is the inorganic or mineral matter; this forms 65 to 70 per cent, with calcium and magnesium phosphate

predominating. These are the substances which give hardness to the bone. The other substances making up the bone are known as organic or animal substances. They form the remaining 30 to 35 per cent, and are in the form of ossein, proteids, and fats; it is these substances which give toughness to the bones.

Bones contain also a varying quantity of water—that is, a spongy bone has more water than one less porous, and the bones of a young person have more than those of old age. Arab children are said to make good bows from the ribs of camels.

If we burn a bone the animal substance is consumed and the mineral is left. It retains its original shape but is extremely frail and brittle. It is also white in color.

If we put a bone in a weak solution

of hydrochloric acid, the mineral substance is dissolved out and we have left the animal. It also shows the original shape of the bone, but is very tough, soft, and flexible; indeed, a long bone so treated can be tied into a knot.

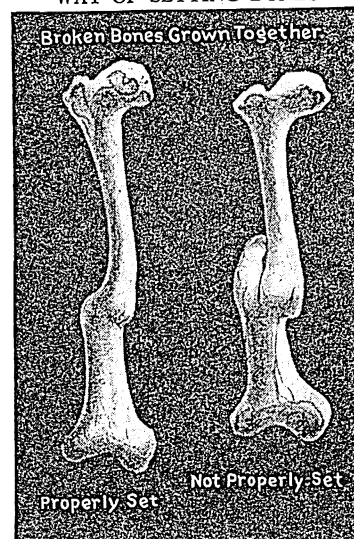
The entire bony system is pierced throughout by a rich network of extremely fine canals. These are filled with lymph, and hence the bone substance is constantly bathed in this life-giving fluid. Blood-vessels enter the bones to renew the lymph. Bone is alive and is kept alive just as the other organs are.

Bone marrow is the source of much blood-building material. It is pervaded by a network of connective tissue, in which are found the cells which make blood corpuscles, the red marrow developing the red corpuscles. This bone marrow is rich in proteids and fats, which makes it highly nutritious when eaten.

Bones grow in a peculiar manner. Cartilage or gristle first appears, a form of modified connective tissue; then the deposit of mineral substance begins, and the bone grows in girth by layers—somewhat like the successive rings under the bark of a tree—becoming harder and more brittle.

There are many commercial uses to which animal bones are put. From them we make buttons, knife handles, and the like; also bone ash, commercial fertilizers of several kinds, and bone black or animal charcoal. This last is made by removing the fats from the bone first—either by boiling or by a solvent;

THE RIGHT AND THE WRONG WAY OF SETTING BONES



A bone set like that on the right is not only easily broken again, but will make the limb crooked and shorter than the other one.

'PLOWING IN THE NIVERNAIS'



This, one of Rosa Bonheur's most famous paintings, depicts a familiar scene in the Nivernais, a province nearly in the center of France where the peasants still employ oxen. Notice how the artist has brought out the slow but powerful movement of these great creatures.

then charring the bones in closed vessels and grinding the charcoal to fine powder. Bone black is used as a pigment and for other purposes (*see Charcoal*). Because they are rich in phosphorus, the bones of animals slaughtered for meat are among our most important materials for making commercial fertilizers. (For the bones of the human body, *see Skeleton*.)

BONHEUR (*bôn-ûr'*), MARIE ROSALIE (1822-1899). What great artist had a private menagerie? The answer is Rosa Bonheur, the great French painter. She spent her life in painting animals, and she so loved her subjects that she made pets of them—even lions, which followed her about like dogs. Monkeys, deer, gazelles, goats, chamois, horses, oxen, and many

THE PYRENEES SHEPHERD AND HIS SHEEP



This painting by the great French animal artist is known as 'The Shepherd of the Pyrenees' and is one of the best examples of her work. A painter can study it for hours and constantly find new things to admire. Notice that although she was first of all a painter of animals, Mlle. Bonheur handled landscape with equal skill. An artist devoting his life to landscape could not have handled better those distant mountain peaks with their cloud mists and their snows, nor the dreary landscape of tumbled rocks and sparse vegetation in the foreground.

other animals had their quarters in her county home at By, in the forest of Fontainebleau near Paris.

This painter studied her animals at first hand. Her father, a struggling artist of Paris and her only teacher, was so interested in the art of his children that, though their home was up five flights of stairs, he always provided some pet for Rosa and her sister and two brothers to sketch. They spent hours in art galleries copying pictures of the great artists, but Rosa liked best to catch the quick movements and changing expressions of living creatures. So, dressed in her brother's clothes, she went often to the stockyards of Paris; there with her short hair and strong features she easily passed as a boy and was freely admitted even to the slaughtering pens, where she studied the anatomy of the animals until she knew their bodily structure perfectly.

When only 18 years old her picture of two rabbits was accepted for the annual *salon*, or exhibition of French artists, in Paris. Five years later from the same institution she received a gold medal. When it was presented to her in the name of King Louis Philippe, the girl replied, "Thank the King for me and tell him I expect to do better." Four years later she ranked as the first animal painter of the day.

When 34 years old the income from her pictures enabled Mademoiselle Bonheur to establish a beautiful country home at By, where, except for occasional sketching trips, she spent the remainder of her life. Many medals and honors were bestowed upon her, and she was the first woman to be made an officer of the Legion of Honor.

Among the many paintings that have brought fame to Rosa Bonheur are 'Deer in the Forest', and 'Weaning the Calves', which, with the well-known 'Horse Fair', now hang in the Metropolitan Museum in New York City. The celebrated 'Horses Threshing Corn', showing ten life-sized horses, was at the time of its execution the largest animal picture ever painted.

BONIFACE, (*bōn'fās*), SAINT (680-754). While the good Pope Gregory the Great sat in Peter's chair at Rome, and Charles Martel, the "hammer" of the Moors, was mayor of the palace in the land of the Franks, the German worshippers of Woden and Thor were slowly being won to Christianity through the patient labors of a native of England whom we know as Saint Boniface. For nearly 40 years he labored in southern Germany—preaching, baptizing, consecrating churches, founding monasteries, and everywhere imposing better order on the clergy and establishing the authority of the Pope. He and his companion monks bore hardships without number, from fire and flood and famine in a savage land; and at last he crowned his life of heroic labor and sacrifice by suffering martyrdom at the hands of the heathen in what is now Holland.

Here is one interesting scene out of many in the life of this great missionary; the place is a gloomy forest in the heart of Germany, in which stood a sacred oak whose massive trunk and branches made it an object of wonder to every beholder. Under it

priests of Woden and Thor still performed their rites of heathen worship.

"Down with that tree," cried Boniface, "for it is an altar to false gods!"

But the pagans called down the curses of their deities upon anyone who should touch the tree, and no one dared to lift the ax against it.

Then said Boniface: "Behold, I will chop it down myself," and fearlessly he applied the ax. And when he had cut into the trunk only a little way, a breeze stirred overhead, and suddenly the wide branching top was broken off and the huge oak crashed to the ground in four pieces, while Boniface stood unharmed. The awed multitude accepted this as proof of the superiority of the Christian God, and agreed to forsake their heathen deities and to become Christians. Out of the wood of the fallen oak Boniface built a Christian chapel.

BONIFACE, POPES. The name Boniface was borne by nine different popes, beginning with BONIFACE I (530-532). BONIFACE VIII (1294-1303) was the most important of their number. In his pontificate occurred a bitter conflict with King Philip IV of France, in the course of which brutal agents of the king seized the aged Pope at his summer home in Anagni, and treated him with such indignity that he died about a month after his release. Shortly afterward Avignon on the River Rhone became, and for about 70 years remained, the seat of the popes—a period sometimes called the "Babylonian Captivity." BONIFACE IX (1389-1404) was one of the popes in the period of "the Great Schism," which followed the return of the papacy to Rome, while anti-popes still held forth at Avignon.

BONN, GERMANY. The ancient town of Bonn is situated on the left bank of the Rhine, about 15 miles southeast of Cologne. Known principally as the seat of one of the greatest German universities, it is also famous for the charm of its old buildings and the natural beauty of its scenery. Pleasant villas with pretty gardens reach down to the river, and its fine promenades and buildings, including a venerable cathedral, make the city a favorite residence for foreign visitors. By far the finest of the buildings is the former palace of the Electors of Cologne, which is now occupied by the university. Founded by King Frederick William III in 1818, the university prospered until it now ranks second to Berlin among Prussian institutions for higher learning. Prince Albert, the consort of Queen Victoria, studied at Bonn, which was a favorite place for the education of Prussian royalty. The University has five faculties—law, medicine, philosophy, and two of theology—an agricultural academy, and a splendid observatory. The city is also the birthplace of Beethoven, whose house is now used as a Beethoven museum. Although it owes its importance chiefly to its university, Bonn has various manufactures—principally of porcelain and stoneware—and carries on an active trade. Population, about 100,000.

The WONDER of a PRINTED BOOK



A GREAT poet, philosopher, or scientist dreams a dream or makes a discovery that is of interest to all mankind. By word of mouth he can carry his message to a few hundreds; with the aid of writing he may reach a few thousands; but by the wonder of modern printing his book can be multiplied by the millions of copies so that his message carries completely around the earth! "As good almost kill a man as kill a good book," said John

Milton. Here you may read the history of bookmaking, from the clay tablets, or papyrus or parchment rolls, to the present days of typesetting machines, photoengraving, power printing presses, and all the elaborate machinery for binding the handsome books which we put in our libraries or carry in our pockets to read as leisure offers.

BOOKS AND BOOKMAKING. "Of making many books there is no end," said the preacher in the Book of Ecclesiastes and this is true to a far greater degree today than it was in the time of Solomon. This is fortunate, for these storehouses of ideas and information preserve for us the best thoughts and the inspiring deeds of men of all times.

The printed and bound volume which we know today as a book is the result of centuries of development. The earliest records of men were scratched on bark or leather or were chiseled on stone, wood, or other durable materials (see Writing). The Babylonians impressed characters on soft clay tablets or bricks, and then baked them hard in square or cylindrical shapes (see Babylon). The laws of Solon were carved on wooden tablets and set up on the Acropolis in Athens; and the 12 tables of old Roman law were similarly engraved on stone. Thin plates of ivory, bronze, or lead were also used for records of public value. These plates were often hinged at one side, resembling in form a modern bound book.

Wax Tablets and Papyrus

For brief notes the Greeks and the Romans used small wax tablets, called in Latin *codex* or *codicillus*. These were made of small boards the surface of which was sunk to a slight depth, except for a narrow raised frame at the edges. Usually holes were bored through the frame on one of the longer edges of each board and usually two or more tablets were fastened together with thongs or metal rings. A thin coating of wax, usually black, was laid over the sunken part of the

wood. Letters were scratched through the black wax so that the light-colored wood showed in the strokes and made the letter visible. This writing was done with a stylus (or stilus), a piece of metal or bone having at one end a sharp point for scratching the letters; at the other end was a knob or a flat surface for smoothing the wax and filling up the scratched strokes, if erasures were needed.

READING AN ANCIENT ROLL



This picture, from an old manuscript, shows how a Roman or Greek read a papyrus roll. As he finished each column, corresponding to a page in a modern book, he unrolled the papyrus with his right hand, and with his left rolled up the column he had just read.

Long documents and books were written by hand on sheets of papyrus (see Paper). The common form of a papyrus book was a roll, or *volumen*, from which our word volume is derived. Sheets of papyrus were not fastened like the pages of modern printed books, but were glued together by the side margins to form a long roll, 5 to 12 inches wide and 15 to 40 feet long, with writing only on one side. Usually the papyrus was rolled around a brightly painted and gilded stick (*umbilicus*), having knobs at both ends. To the top of the roll was attached a slip of vellum on which was written the title of the work with the name of the author. Each roll was kept in a cylindrical parchment case. In reading, the roll was held in the right hand and unrolled column by column while the left rolled up on

another wooden roller the part that was already read. When the reader had reached the end of the roll, it was customary to rewind the volume tightly upon the *umbilicus* by holding the roll beneath the chin and turning with both hands. Many of these papyrus rolls have been found in the coffins of mummies in the tombs of Egypt. The dry air of that country, together

with the cedar oil in which the papyrus was steeped, has so preserved them that the writing is still clear and distinct.

Parchment, Better Than Papyrus

Although papyrus was the material used for most ancient books, special copies were often written on vellum or parchment. Vellum was made from calfskin. Parchment, a coarser material, was made from the skins of sheep and goats. The skins were not tanned, but were prepared by careful washing and then covered with lime to loosen the hair. After the hair was removed, each skin was stretched on a frame, scraped, dusted with sifted chalk, and polished with pumice. Vellum is probably the most lasting and the most beautiful material ever used for books, but it is very expensive. It is also hard to handle on a printing press, and so it is little used today except for special copies of fine books.

Parchment and vellum were used as early as the 5th century B.C. From the beginning of the Christian era these materials gradually displaced papyrus until by the middle of the 5th century the usual material for a book was vellum or parchment sheets. The sheets were cut to uniform size and bound together at one side with leather thongs.

Books in the Middle Ages

For nearly a thousand years after the fall of Rome all books were laboriously written out by hand. The pens were made from a reed or a quill from the wing of a large bird. These pens were cut with a broad end or nib, shaped like a chisel, instead of with a split point such as our pens have. A wide stroke was made by using the full width of the pen; when the pen was turned at a right angle a very thin line was made by the side of the nib; a line which changed gradually and evenly in width could be made by turning the pen between the fingers as the stroke was being made. The forms of modern type

A MONK AT WORK IN HIS SCRIPTORIUM



Here you see a typical arrangement in a scriptorium or writing room. You can see the ruling which marks the margins, and the guide lines for the writing. Above the vellum sheet on which the scribe is working is a smaller desk or rack holding the book which he is copying.

letters still show the thick and thin strokes which the pen gave them during the Middle Ages, for our type letters were directly derived from the old manuscript letters.

The ink used for writing on vellum, and later on paper, was either lampblack ink, which had already been used for papyrus, or a new ink made from iron filings and oak-bark, or gall nuts, which contain tannin, boiled in vinegar. Gum arabic was added to bind the black particles to the vellum. Before beginning to write the

scribe ruled the page, marking off the margins and drawing guide lines for the writing. This ruling was done with a pointed metal stylus, or with a sharpened

piece of lead, or with a pen and diluted ink. The writing desk was placed at a sharp angle, so that the leaf to be written on was in front of the scribe in an almost vertical position. Above the desk was usually another smaller one to hold the book from which the text was to be copied.

Most medieval manuscripts were the work of monks. In some monasteries the scribes worked at separate desks placed in a large room called the *scriptorium*. At times they wrote from dictation, but more often, when a book was wanted in a hurry, it was divided among a number of scribes. In other monasteries, especially in the earlier Middle Ages, each monk worked in his own cell.

Styles in Handwriting

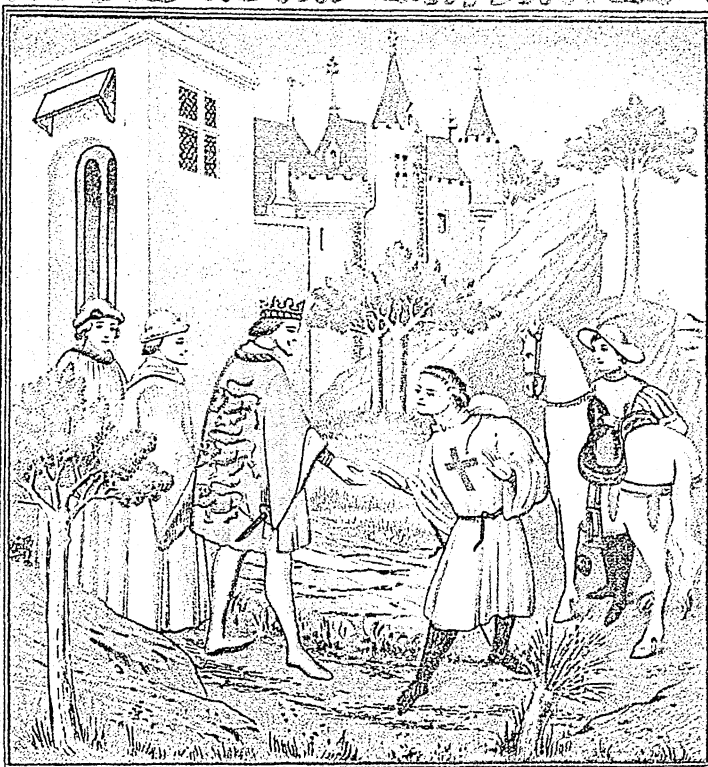
The form of the letters used for manuscript books in Latin changed from century to century, from country to country. In the Roman period there were at least five distinct styles of handwriting. First came the capital letters, which were divided into two forms, the *square capitals*, a formal letter intended for inscriptions and more stately manuscripts, and the *rustic capitals*, somewhat freer and easier to make, also used for manuscripts and for less formal inscrip-

HOW HANDWRITING CHANGED

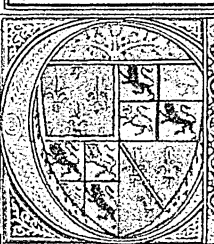
| | |
|-----------------------------------|------------------------|
| FORMAL-WRITING | |
| A.D. 1-500 | SQUARE CAPS |
| 1-500 | RUSTIC CAPITALS |
| 400-800 | UNCIALS |
| CURSIVE-WRITING | |
| 1-500 | CURSIVE becomes |
| | [H·H H h h·h] |
| 400-800 | half uncials |
| 800-1200 | small roman |
| 1200-1450 | Gothic |
| 1450 | Gothic |
| 1400 | small roman |
| 1400 | Italics |
| BOOKHANDS A.D. 1 to 1450 ± | |

The forms of written letters were constantly changing, until the scribes perfected the styles which prevailed about 1400. Other specimens of written letters are shown on page 177.

for inscriptions and more stately manuscripts, and the *rustic capitals*, somewhat freer and easier to make, also used for manuscripts and for less formal inscrip-



Comment mestre guillaume de mandeville en ala outre mer



omme il soit ainque la terre doulce mer cest alle
 noir la sainte terre de promission en trestoutes le
 autres terres cest la plus excellente et la plus digne
 et dame souveraine de toutes autres terres et henou
 et sainte et consacree du precieus corps et du preu
 sang nre seigneur ihesu crist, ou ly pleut soy enom
 ber en la glorieuse vierge marie et prendre char hu
 maine et nourrir et la terre mardier et emiron
 de roies et la noult il maint miracles faire et prechier et enseigner la joy et la
 loy de nous crestiens comme a les enfans et de cette terre noult singuliere

A PAGE FROM A MEDIEVAL BOOK

THE preceding plate shows a brilliant example of book work in the Middle Ages, with illustrations, decorations, and text that had to be painted and lettered by hand in every copy. This page is from an old French book of travels and adventure, called 'Les Merveilles du Monde' (The Marvels of the World). It was executed about the year 1410 by a number of scribes and artists on behalf of Jean Sans Peur, Duke of Burgundy, who presented the volume to his uncle the Duke of Berri. The original is in the Bibliothèque Nationale, Paris. Lithographic copies of some of its pages were prepared in 1859 by Henry Noel Humphreys for his 'Illuminated Books of the Middle Ages', and from that work our reproduction is taken.

The original volume comprises a number of chapters or "books" compiled from the writings of several early medieval travelers. At the top of our page we read in French, "Here begins the book of Sir William de Mandeville." Under the picture or "miniature" of Mandeville bidding farewell to his king while a page waits with his horse, is the caption, "How Sir William de Mandeville betook himself overseas."

The text then launches into an account of the traveler's religious motives for setting out toward his first destination—the Holy Land. The scribe who wrote this page appears to have made a curious "typographical" error in the hero's name. Students of medieval literature will recall the 'Narrative of Travels' ascribed to a certain Sir *John* Mandeville which appeared in French about the year 1360 and which was later translated into English. The text of that narrative is substantially the same as the one in 'The Marvels of the World', but the name has been changed from John to William, evidently due to misreading manuscript signatures, in which first names were often ingeniously abbreviated.

The entire Mandeville narrative is today regarded as the fabrication of a certain Jehan à la Barbe (John the Bearded), also known as Jean de Bourgogne, a physician of Liège, who posed as an English knight. His inventions, however, were sufficiently ingenious to be included in 'The Marvels of the World' along with the writings of the very men from whom he is supposed to have borrowed his material—Marco Polo, Oderic, and others.

tions. From the capitals, later called *majuscules*, the Romans developed a cursive handwriting, characterized by the roundness of the letters, which was used for correspondence, accounts, notes, and scribbles of all sorts. This style of writing was called *uncial*, perhaps because its letters were round, like the Roman *uncia*, a copper coin. From the uncial forms the printers of the 15th century developed the early type face called "black letter." Uncial writing also developed a difference between tall and short letters, and from it the first *minuscule* or lower-case alphabet was gradually developed.

The early medieval scribe combined the uncial letters with the careless letters used in writing on wax tablets (*codices*), which had strokes running above and below the regular line of letters. These new combinations were called *half-uncials*. Instead of being, like the uncial writing, mostly capitals with a few small letters, half-uncial writing was based on minuscules, or small letters, with only an occasional large letter.

Next there developed from the half-uncials a kind of writing which is the ancestor of our small lower-case letters. It is the *Carolingian minuscule*, the small letter used in the time of Charlemagne. The Carolingian writing was a partial return to the letter forms of the early Roman manuscripts. Its beauty and simplicity caused it to spread throughout France, and it soon became the dominant style throughout all of Europe except Ireland. It was introduced into England about the 10th century, but was there used first only for Latin texts,

TYPES AND THEIR WRITTEN SOURCES

prior taceat et ipse prophetarum
prophetis subleccasunt et mulier
in edesius taceant et si quis lenos

Carolingian minuscule, of the 10th century, the first Roman small letter, used from 1000-1200 A.D.

dec. Et intrareti
cular ut expm

Angular Gothic writing (left) from 14th century English manuscript. Angular Gothic type (right) based on writing, from 42-line Bible.

i preceptis protinus subdidit
frenum qui in celis est. Qui
da essent uel qualiter no videri

Flemish secretary hand (left) of 15th century, derived from Angular Gothic. Type used by William Caxton (right) derived from this hand.

procurant ut magister fieret
magnates et nobiles non satis
cursum preter paucos sibi aut

Roman book hand (left), Italian 15th century, a revival of Carolingian minuscule. Type of Nicolas Jenson (right) patterned after it.

ruppeno et disporomo. La occiso
el di de Romani et de Karthagi

Italian book hand (left) 15th century, derived from Roman book hand above. The first italic type (right) by Aldus Manutius, after 1501.

in his partys and kyngdom many
glond with tounes and castels and
and many harmes shames and des
Whe for kyng Edward whan he fere

extinguitur ut coepit: & si quid ita con
ri posse ut illi probetur. Cicerone
litteris uideri illius causa uoluisse
scis: quod ego astimo: q in ea cam

car. Quis quidem subinde aliquorum miserrima
fiere iucundum, ne celesti uerecundia tua, laudes su
que, que facilius te fingere possunt, quam nos satiare.

tu Georgio Cardinali Giosfredus Carlius S
diolanensis Praefes, iuris intelligentia clarus
rendas ferenda liris occasiones egregie ca

Fine types designed by Claude Garamond in France, about 1530, forerunner of Caslon.

ENGLISH ROMAN.
Quousque tandem abutere, Catilina, patientia
nostra? quamdiu nos etiam furor iste tuus eludet?

Types of Caslon, generally considered the most serviceable face designed in England.

Book I. PARADISE REGA

For that to me thou seem'st the man, who
Our new baptizing prophet at the ford

Types of John Baskerville, who thinned the light lines and widened the heavier ones.

Quousque tandem abutere, Catilina, patientia
nostra? quamdiu nos etiam furor iste tuus eludet? quem ad

Bodoni, 18th century Italian typefounder, overemphasized the light and heavy lines.

none hys hande was as hole as it had ben tof
of this myracle a sygne of the cutting abode

William Morris' Golden type was a return to the letter of Jenson, but was heavier.

O Melampus! who would fain know the life
why did it please the gods to direct your steps to
most melancholy of them all? It is long since I

Bruce Rogers' Centaur type is probably the finest type designed by an American.

thus establishing a fashion which continued even after the introduction of printing; Latin classics, for example, were always printed in "roman" type, whereas law books were always printed in "black letter."

In the later Middle Ages, beginning about the 12th century, there was a new development of national handwritings, all derived from the Carolingian but easily distinguished from each other. This was a period of popularity for large books, adorned with initials and borders in bold designs. The strokes of the letters were made wider. In Italy, southern France, and Spain the letter forms remained round. In England, northern France, and the Low Countries they took the pointed form

known as angular Gothic. German script, although in the northern group, held a place by itself and was generally less graceful in character than any of the others. This Gothic small letter, which developed slowly during several centuries became the lower-case "black letter" of the early printers.

Finally in the 15th century came the "humanistic" writing, which was a rounded hand, an attempted revival of the old Carolingian minuscule. It was a logical result of the revival of learning, for the new vogue of the classic writings of antiquity brought back the handwriting in which those works were found. These 15th century copies of the Carolingian hand became the models of modern "roman" type faces. Humanistic writing, like all other period forms, included both a formal book hand and a more flowing form. The latter became the common handwrit-

ing of all countries which had used the humanistic roman letter for books. All italic types are based on this form of flowing or cursive letter.

How Medieval Books Were Made

The medieval book, or codex, was made of leaves bound up in order as in our printed books. The common practise was to take four pieces of vellum and fold them so that each piece formed two leaves. These pieces were then fitted one inside another to form a group of eight leaves, called a section. As many sections as were needed for the entire book were sent to the scribe, who took them apart, wrote the text a single page at a time, and perhaps put in the red headings and initial letters. Unlike papyrus, which was so thin that only one side could be used, vellum was thick enough to allow writing on both sides.

After being read and corrected, the sections of the book were sent to the binder, who sewed the sections through the back fold with cords. Wooden covers slightly larger than the leaves were made and the ends of the sewing cords were laced through holes in the boards to bind together the sections and the covers. Next a large piece of leather was glued over the back of the sections and the wooden sides. Sometimes this cover was decorated with patterns pressed into the leather with heated metal stamps. Because vellum wrinkles when it gets very dry, strips of leather with clasps were usually attached to the front edges of the boards so that the vellum leaves might be kept flat under pressure and no dust might get between them. If the book was large, metal corner-pieces with knobs were often added to keep the leather cover from touching the desk and so from being marred.

Many medieval books, especially those made for use in the church services, have beautiful decorations and illustrations painted in them in bright colors and gold. The decoration of a book with initial letters, borders in the margins of the pages, and little pictures called "miniatures" is known as "illumination."

The colors were prepared by the illuminator himself from colored earths and other substances, finely ground and washed and mixed with gum to make the particles of color hold fast to the vellum. Gold was beaten into very thin sheets and glued to the

page, or was ground into a fine powder, mixed with gum and oil, and made into a paint.

By far the greater number of medieval books were Bibles, missals (books containing the service for the celebration of mass), sermons, and other religious writings. Next in importance were books of law, medicine, and natural history, astrology, the works of Greek and Roman authors, and later a few chronicles and romances. Most medieval books are in Latin, although some of the later ones are in English, French, and the other European languages.

Among the most famous of all manuscript books are several copies of the writings of the Latin poet Vergil, now in the Vatican library. They were probably made during the 3rd century A.D. These are the earliest books in codex form which have survived to the present time. Another famous manuscript is the Codex Sinaiticus, the oldest complete manuscript of the New Testament in Greek. It was discovered by a Biblical scholar at a monastery near Mount Sinai in a basket of rubbish about to be burnt. (A photograph of a leaf of this manuscript is shown in the article Bible.) Another manuscript noted for its beautiful writing

and fine interlaced decorations is the Book of Kells. This is a copy of the four Gospels made in Ireland during the 8th century.

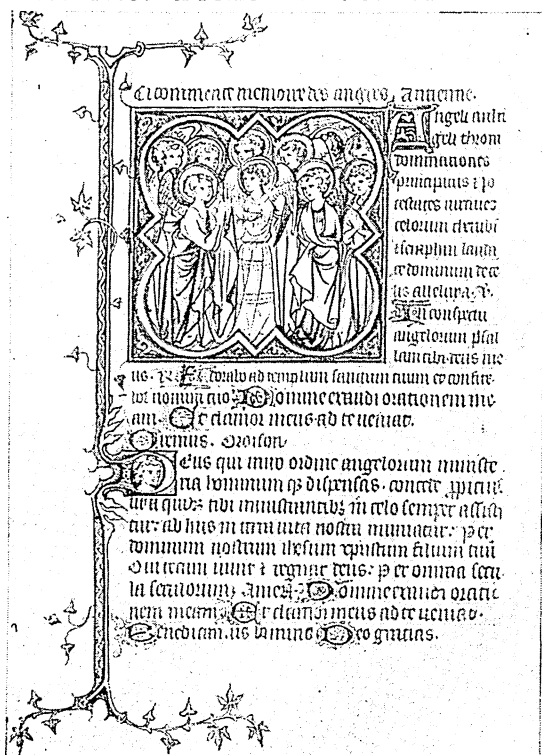
Manuscripts of Three Periods

The history of books in the manuscript period may be divided into three periods. In the first and longest, ending about the year 1200, the making of books was carried on by monks. In the second period, which covers roughly 200 years, the work of the monks was supplemented by literary activity in the universities, especially those at Bologna, Padua, Paris, Oxford, and Cambridge. In the third period, beginning about the year 1400, book-making and bookselling existed in the cities on a commercial basis. Venice, Florence, and Paris were the chief centers of production, and the annual fair at Frankfort was the market where scholars could find a

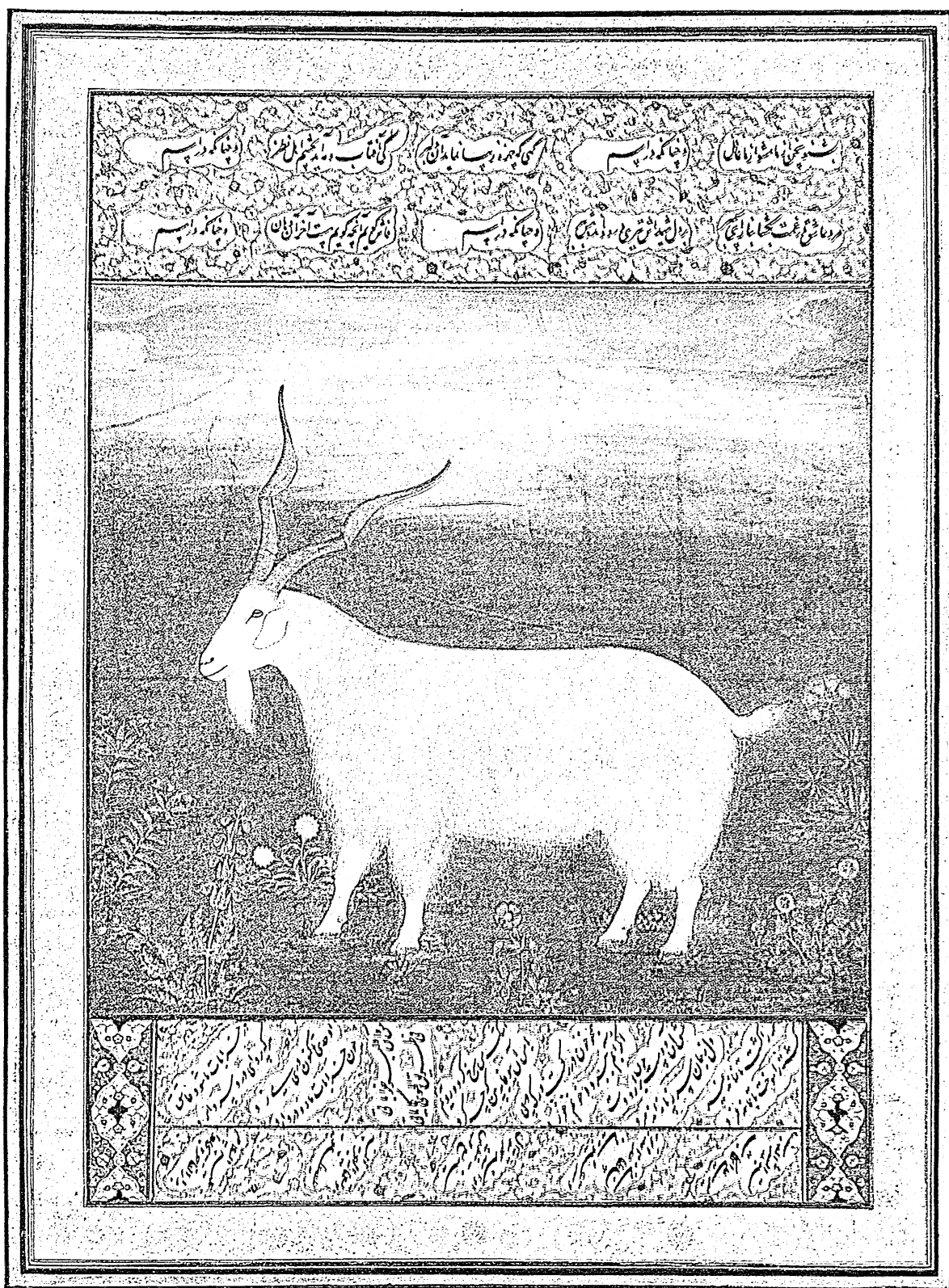
copy of almost any book then in existence.

In the first period the literature of ancient Greece and Rome was saved for us largely through the efforts of two early churchmen, Cassiodorus and St. Benedict. Cassiodorus was court secretary and official

PAGE FROM A FRENCH BOOK OF HOURS



The miniature is of high artistic quality, and the artist showed ingenuity in the splendid initial "D" which gives unity to the page. The ample margins also show good taste.



From the Lucy Maud Buckingham Collection

By courtesy of The Art Institute of Chicago

A PERSIAN MINIATURE OF THE 16TH CENTURY

A PERSIAN MINIATURE OF THE 16TH CENTURY

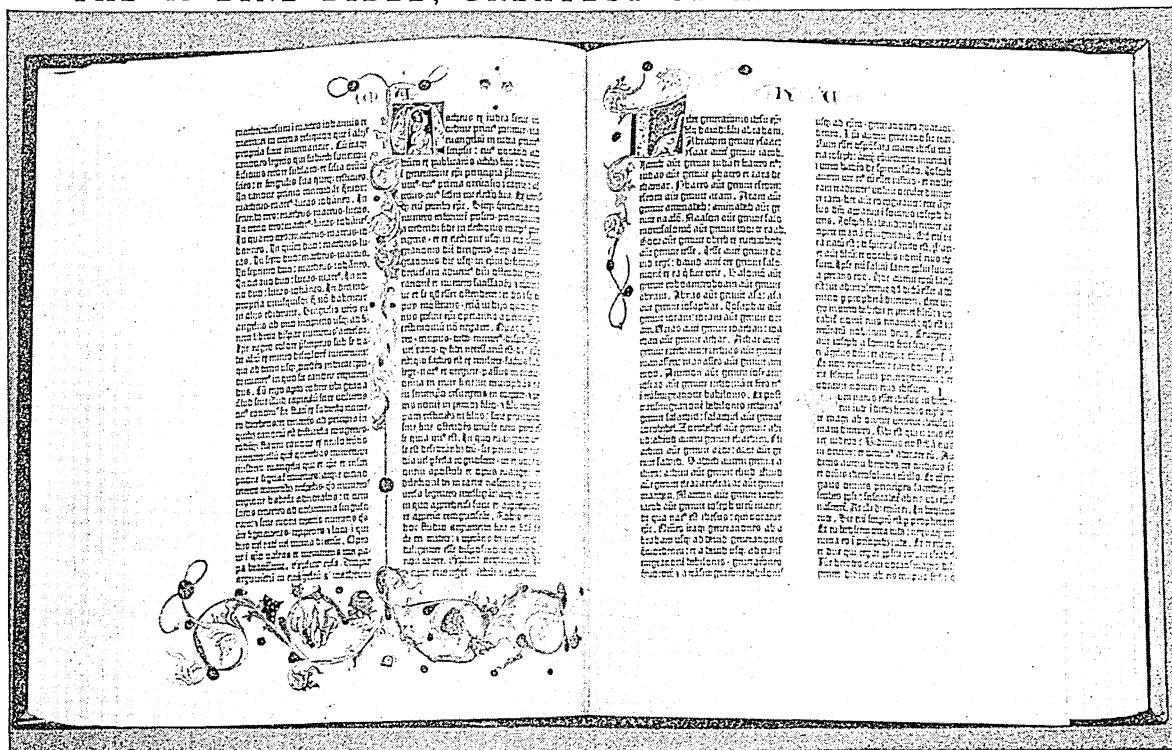
THE art of bookmaking in Persia reached a high degree of development before the year 1,000. The refined handwriting called calligraphy and the illumination of manuscripts were, indeed, for many centuries regarded as essential in the reproduction of religious and poetical works.

At the period when the miniature on the preceding page was produced, Persian taste had come to lay more stress upon the pictorial appearance of book pages than upon the value of the text which they contained. Notice how the writing is set off in irregular but balanced panels above and below the painting of the goat, some lines running horizontally, others diagonally or perpendicularly to suit the designer's notions of beauty. So far as this text can be deciphered, it consists of an elaborate riddle in verse. The excuse for including the picture is an untranslatable pun derived from the Persian word for "goat." The date of the work is included in the riddle and reads "939 of the Prophet's Hegira," corresponding to the year 1533.

However slight may be the value of the text, the work of the artist who painted the goat and its background shows skill and a typically Persian love for careful detail. Many of the tiny hairs of the animal's coat were separately painted with a brush of extreme fineness. The little flowers are characteristic also, as their brilliant colors stand out like jewels against the darker background.

Many of the Persian books composed during this period consisted of collections of pages like this one, with no connected text running through the volumes.

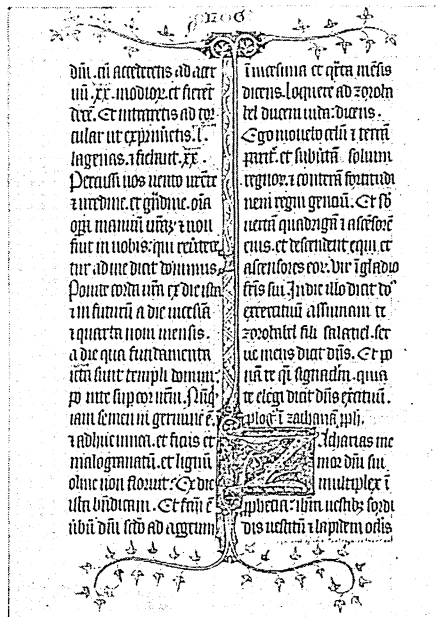
THE 42-LINE BIBLE, GREATEST OF ALL PRINTED BOOKS



spokesman for Theodoric, and through his efforts the court at Ravenna became the center of literary activity. Cassiodorus was the first to insist that the monks should include intellectual labor in their duties, and he himself set an example by writing a history of the Church and a vast amount of other work both original and compiled.

St. Benedict specified that a certain number of hours were to be spent each day in the scriptorium or writing room. Work as scribe was accepted in place of an equal number of hours of outdoor labor. For centuries the Benedictines were the most powerful of the monastic orders, and it is scarcely possible to exaggerate their influence in preserving the works of the Greek and Roman authors as well as those of St. Augustine, Gregory, Jerome and others of the church fathers. (See Bible; Gregory, Popes; Monks and Monasticism.)

The earliest surviving manuscript known to be the work of a European monk dates from the year 517, but even before this date much copying had been done in the monasteries of northern Africa and the Near East. Most of the Greek texts which found their



authorized copies of texts required in university courses, and rented these to students and teachers. When students died or left the university their books were turned over to the stationers; to take books away was a crime.

Gradually, as the universities grew in size, it became the practise for the stationers to sell their texts instead of renting them, and with this change

This was the first important book printed from movable type. Although this illustration is too small to show in detail the form of the individual letters, you can see that in general appearance they resemble those on the manuscript page below, which was written in England in the 15th century. Both book and manuscript letters are Angular Gothic.

way into Europe at the time of the Renaissance came from those monastic libraries.

Bookmaking in Universities

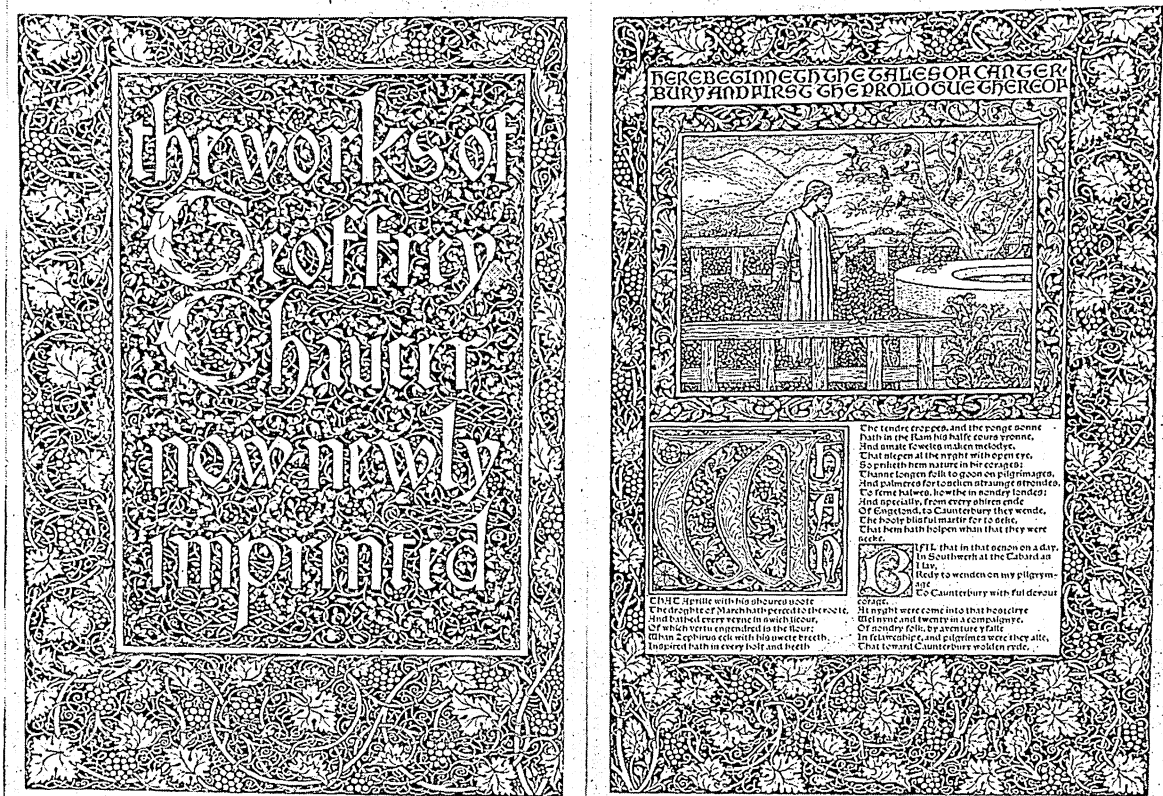
About 1200 there was a change in the intellectual life of Europe, which was henceforth directed from the universities. Alongside the production of books by monks came the work of lay scribes who were recognized as university officials. The word stationer (*stationarius*) first appeared at Bologna about 1250. The stationers kept in stock a sufficient number of

came a change in name from stationer to librarian (*librarius*). The early book dealers were really librarians as we understand the word today, for they loaned books (for a fee), and also permitted students to examine texts without removing them from the shop. The university regulations specified that the

known in Europe at least 300 years earlier. (See Paper.)

Before the invention of movable types, small religious books were printed in Europe from engraved blocks of wood. Each block was the size of the page, and consisted usually of a picture with a small amount of descriptive lettering beneath it. These books are

A MONUMENT OF TYPOGRAPHY, THE MASTERPIECE OF WILLIAM MORRIS



The title and first text page of the folio Chaucer, printed by Morris at the Kelmscott Press in 1896, show how Morris treated the double-page of the open book as a unit. The borders and initial letters were drawn by Morris, and the illustration was done by Sir Edward Burne-Jones. This book, with the Doves Press Bible and Bruce Rogers' Centaur, are prized examples of modern typography.

booksellers must not modify the text in any way, and penalties were provided for renting or selling texts in any form other than that prescribed by the faculty. These booksellers were considered professional men, not ordinary tradesmen. In Paris they constituted a guild within the university. Admission to the guild was restricted to men of character and standing.

In England and in the Low Countries the book trade was not so closely tied to the universities, and had a larger influence on the general education of the people than in Italy or France. As early as 1400 there was an organized trade in books at Ghent, Antwerp, and Bruges, in both scholarly and popular books. In Germany the 15th century scribes gave much time to the production of textbooks, almanacs, and books on astrology, cooking, and other popular subjects.

The cost of books was greatly reduced by the introduction of paper. The use of paper began to spread about the 11th century, although it was probably

known as "block books" and the method by which they were printed is called "xylography" as contrasted with "typography," or printing from movable types. How movable types came into existence, and how their use spread throughout the civilized world, is told in the articles Printing and Typography.

Early Printing Looked Like Writing

The effort of the first printers was to make their product appear as nearly as possible like manuscripts. The style of type, the use of abbreviations and special signs, the use of woodcut illustrations in Bibles and prayer books, all followed the practise of the scribes. Blank spaces were left for large initial letters, to be drawn and illuminated by scribes after the book was printed. When woodcuts were used in printed books, they were often hand colored.

But as the press multiplied books by the thousand certain changes in their physical appearance were introduced. Some of these changes were made neces-

sary by the conditions of machine manufacture. A scribe found it simple to use several colors in his writing. By merely wiping his pen he could shift from one ink to another. For the printer every additional color made his work at the press more difficult—he must make a separate impression for each different color. The introduction of printing usually meant a reduction of the gay colors of the manuscript to simple black or white.

Other changes in the form of the book were introduced for the convenience of booksellers and readers. In the manuscript days books were costly. No single person could own more than a few of them. These he could tell apart at a glance by their general appearance. There was no need for title-pages and none existed. Usually a manuscript began with the name of the author and his subject at the head of the opening paragraph. Sometimes it ended with the name of the scribe, of the place, and the date when he finished it. Occasionally the preliminary statement of author and subject (the *incipit*), and frequently the scribe's record (the *colophon*), were both omitted. In some of the earliest printed books space is left for a pen-written incipit; many of them have no colophon, showing where, when, and by whom the book was printed. But gradually, with the increase of books, the need of these distinctive labels became more and more pressing. Finally, for the convenience of booksellers and their customers, both items were printed plainly on the first leaf of the book. This is the origin of the modern title-page. Other features were added from time to time as aids to the reader.

Rival publishers endeavored by continuous improvements to recommend their products. A series of books selected from successive decades will show a gradual evolution from the bare text to title-page, introduction, table of contents, foot-notes, maps, illustrations, tabular arrangement, commentary, index, and errata.

By the year 1550 we find the modern book in its present-day form. It begins with a "half-title," giving

PERFECTION IN TYPOGRAPHY

IN THE BEGINNING

GOD CREATED THE HEAVEN AND THE EARTH (AND THE EARTH WAS WITHOUT FORM, AND VOID; AND DARKNESS WAS UPON THE FACE OF THE DEEP, & THE SPIRIT OF GOD MOVED UPON THE FACE OF THE WATERS. ¶ And God said, Let there be light: & there was light. And God saw the light, that it was good: & God divided the light from the darkness. And God called the light Day, and the darkness he called Night. And the evening and the morning were the first day. ¶ And God said, Let there be a firmament in the midst of the waters, & let it divide the waters from the waters. And God made the firmament, and divided the waters which were under the firmament from the waters which were above the firmament: & it was so. And God called the firmament Heaven. And the evening & the morning were the second day. ¶ And God said, Let the waters under the heaven be gathered together unto one place, and let the dry land appear: and it was so. And God called the dry land Earth; and the gathering together of the waters called he Seas: and God saw that it was good. And God said, Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth: & it was so. And the earth brought forth grass, & herb yielding seed after his kind, & the tree yielding fruit, whose seed was in itself, after his kind: and God saw that it was good. And the evening & the morning were the third day. ¶ And God said, Let there be lights in the firmament of the heaven to divide the day from the night; and let them be for signs, and for seasons, and for days, & years; and let them be for lights in the firmament of the heaven to give light upon the earth: & it was so. And God made two great lights; the greater light to rule the day, and the lesser light to rule the night: he made the stars also. And God set them in the firmament of the heaven to give light upon the earth, and to rule over the day and over the night, & to divide the light from the darkness: and God saw that it was good. And the evening and the morning were the fourth day. ¶ And God said, Let the waters bring forth abundantly the moving creature that hath life, and fowl that may fly above the earth in the open firmament of heaven. And God created great whales, & every living creature that moveth, which the waters brought forth abundantly, after their kind, & every winged fowl after his kind: & God saw that it was good. And God blessed them, saying, Be fruitful, & multiply, and fill the waters in the seas, and let fowl multiply on the earth. And the evening & the morning were the fifth day. ¶ And God said, Let the earth bring forth the living creature after his kind, cattle, and creeping thing, and beast of the earth after his kind: and it was so. And God made the beast of the earth after his kind, and cattle after their kind, and every thing that creepeth upon the



THE CENTAUR. WRITTEN BY MAURICE DE GUÉRIN AND NOW TRANSLATED FROM THE FRENCH BY GEORGE B. IVES.



Was born in a cavern of these mountains. Like the river in yonder valley, whose first drops flow from some cliff that weeps in a deep grotto, the first moments of my life sped amidst the shadows of a secluded retreat, nor vexed its silence. As our mothers draw near their term, they retire to the caverns, and in the innermost recesses of the wildest of them all, where the darkness is most dense, they bring forth, uncomplaining, offspring as silent as themselves. Their strength-giving milk enables us to endure without weakness or dubious struggles the first difficulties of life; yet we leave our caverns later than your cradles. The reason is that there is a tradition amongst us that the early days of life must be secluded and guarded, as days engrossed by the gods.

My growth ran almost its entire course in the darkness where I was born. The innermost depths of my home were so far within the bowels of the mountain, that I should not have known in which direction the opening lay, had it not been that the winds at times blew in and caused a sudden coolness and confusion. Sometimes, too, my mother returned, bringing with her the perfume of the valleys, or dripping wet from the streams to which she resorted. Now, these her home-comings, although they told me naught of the valleys or the streams, yet, being attended by emanations therefrom, disturbed my thoughts, and I wandered about, all agitated, amidst my darkness. 'What, I would say to myself, are these places to which my mother goes and what power reigns there which summons her so frequently? To what influences is one there exposed.

Above is the first page of the Book of Genesis from the Doves Press Bible; in the original the initial "I" is printed in red. Below is the first page of "The Centaur," designed by Bruce Rogers.

only a short or condensed title followed by the title-page giving the full title, the name of the author, the name of the publisher and the city in which his business is located, and the date of publication. On the reverse of the title may be placed the copyright notice and the name of the printer, if the printer and publisher are not the same person. Then may follow a page for the dedication, if there is one, after which often comes a preface or foreword, stating the plan and purpose of the book. Books of informational character have an index following the body of the text. A bibliographical description of a book gives all this information in brief form (see Bibliography).

Book Sizes

Formerly, the sizes of books were indicated by an abbreviation, such as 8vo or 12mo. When all paper was made by hand, the sheets were all about the same size. Then the number of times the sheet was folded, to make the pages of the book, indicated closely enough the size of the book. If a full sheet was folded to make two leaves of four pages, it was said to be in-folio; folded into four leaves, it was in-quarto, or simply quarto, abbreviated as 4to; if eight leaves, it was octavo, 8vo; and so on to 64mo and 128mo.

When paper sizes were no longer uniform, as the result of the introduction of machinery, book sizes were often described in terms of the paper sizes used; thus a folio might be elephant, imperial, atlas, royal, demy, medium, crown, or foolscap in size. It was not always possible to tell on inspection whether a book was a small folio or a large quarto, a small 8vo or a small

12mo. A sheet of imperial paper was 21x31, while demy, so named because it was half of the imperial, was 21x16; thus an imperial quarto, printed on imperial paper and folded twice, was almost identical in size with a folio printed on demy size. Although some booksellers and publishers still use the old names, the tendency is to eliminate confusion by stating sizes either in inches or in centimeters.

The Fine Art of Book Binding

THE processes of binding a book by hand are substantially the same as they were 500 years ago. The necessary equipment includes a sewing frame, to hold the folded sheets while the sections are being sewed to the cords or tapes which run across the back, and two presses, the first to hold the sewed book while the back is rounded by gentle hammer taps, and the second to hold it while the covers are put on. In hand-binding, unlike machine- or case-binding, the sewing tapes are fastened directly to the stiff board sides before the cloth or leather covering is put on.

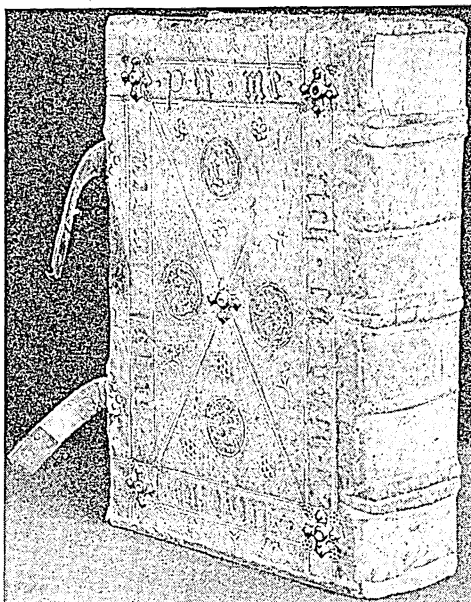
Decorated Covers

For decorating and lettering the cover, small brass stamps, set in wooden handles, are used. A wheel called a filet makes plain lines, and wider wheels, called rolls, with various patterns on the edges, are used for ornamental bands or borders. In gilding the edges the first step is usually to spread a thick red stain; after this is dry and carefully brushed, the binder applies a "glaire," made of whites of eggs beaten up with water or vinegar, and then lays on very thin gold leaf. When the glaire is quite dry, and the gold has set, the edge is burnished by rubbing with a smooth piece of stone or leather. Sometimes landscapes are painted on the fore edge in such a way that they are only visible when the edges are slightly fanned; gilding is then applied as usual to the edge, over the painting.

"Full" and "Half"

Bindings

Although the processes of hand binding have remained the same, there have been great changes in materials used and in the style of decoration. The earliest bindings, even for small books,



Most 15th century bindings were made of oak boards, covered with pigskin, ornamented with stamping in blind. The metal bosses protected the bindings, and the clasps held the covers together.

were usually of oak boards. Sometimes the boards were covered with leather or vellum; these are called full-bound. Sometimes the boards were left exposed, only enough of the leather or vellum back being fastened to the edges to hold the sides; these are called half-bound. The ornamentation of the back and sides became a special art, called "finishing."

Use of Paper and Cloth

As the production of books increased and the size of the volumes decreased, the binders began to substitute paper board of various kinds for oak. About the beginning of the 19th century glazed calico was first tried as a cover for the paper boards, and about 1830 cotton cloth of various kinds was introduced in England.

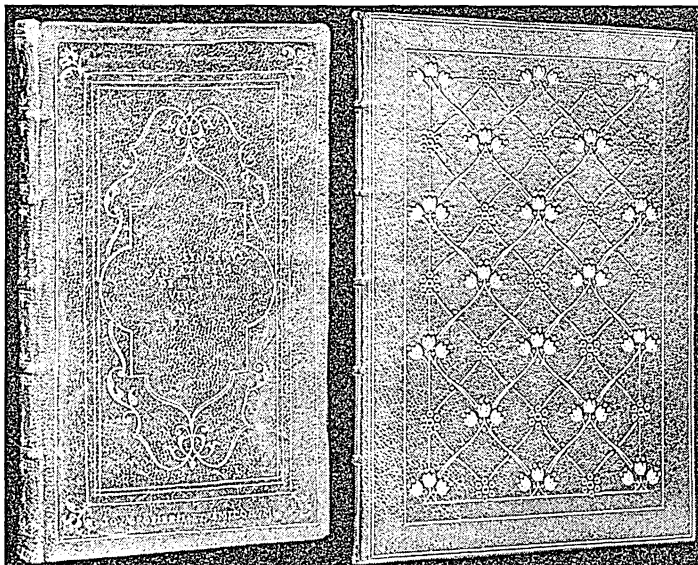
The use of cloth created new possibilities in decorative binding. Cloth is more easily handled than leather or vellum, and is easily marked by stamps or dies. It permits binding large editions in identical designs at low cost. The best grades of cloth for binding are buckrams. In the United States and Great Britain, most new books are bound in cloth. In continental Europe most books are issued in paper covers. Special

permanent bindings are put on later if the owner so desires.

As early as the 4th century many manuscript volumes were elaborately bound; but most of them were later destroyed for the gold, silver, gems, or carved ivory with which they were ornamented.

The binding of books, like the printing of them, was centered at first in the monasteries and church schools, was then transferred to the universities, and later to the commercial printing and binding establish-

OLD AND NEW IN BEAUTIFUL BINDINGS



Jean Grolier, in the 16th century, had his books bound by the best binders of his day. The book at the left shows one of his simpler patterns. At the right is a 20th century design by Cobden-Sanderson, for an essay on *The Ideal Book*, written by him and printed at his Doves Press.

ments. By the end of the 15th century a few bindings appeared with the names or devices of printers or binders stamped on them. Some early printers, notably Koberger at Nuremberg, developed styles of bindings still associated with their names, but most of the styles take their name either from a famous collector or patron or from the name of the binders.

Gilded Decoration

A great variety of decoration was made possible by the introduction of gilding, about the last quarter of the 15th century. In Germany blind stamping (that is without gilding) remained the fashion even into the 18th century, but in Italy, France, and to a less degree in England, leather stamped in gilt became the material for fine bindings. In France, through nearly three centuries, the art of binding received magnificent support from kings, queens, nobles, and clergy, whose favorite books have since become the pride of museums, libraries, and private collectors. Jean Grolier, one of the greatest book collectors of the 16th century, had most of his books bound in leather, covered with geometrical patterns inlaid with contrasting bits of leather or colored enamels. Maioli bindings, made for Thomas Mahieu, secretary to Catherine de' Medici, and the English bindings made for Sir Thomas Wotton, are similar in general pattern to the Grolier books. The royal binders, Nicolas and Clovis Eve, the unknown binder known as "Le Gascon," later Padeloup and the two Deromes, uncle and nephew, each developed definite styles of decoration which are still associated with their names. In mechanical finish the work of these early binders is often inferior to that of the best contemporary workmanship, but in design it has not been surpassed.

In England in the 17th century, Samuel and Charles Mearne developed a "cottage" style of decoration, taking its name from a roof-like pattern which they used in almost every binding. After the Mearnes there was no important English binder until Roger Payne,

one of the truly great binders. Payne showed great skill in combining small patterns with proper blank spaces. Payne's designs were followed with varying closeness in the 19th century by Charles Lewis, Kalthoeber, Walther, Francis Bedford, and later on a greater commercial scale by the firms of Riviere and Zaehnsdorf. John Edwards of Halifax developed an original style, usually called Etruscan from the patterns he used. Edwards made a specialty of a transparent vellum, the under side of which was decorated with landscapes or allegorical paintings, and he also excelled in fore-edge painting, specimens of his work being now highly prized.

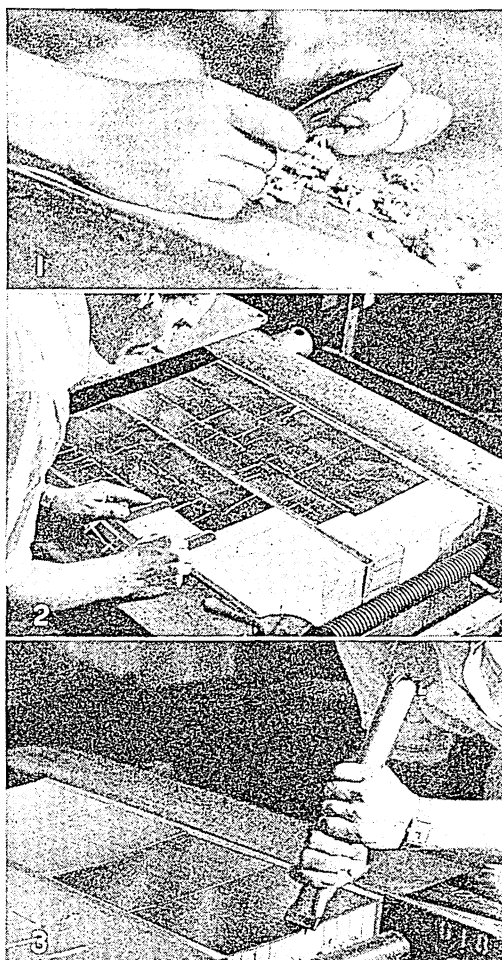
Modern Designs

Design in bookbinding received a new inspiration towards the end of the 19th century, coincident with the artistic revival in printing for which William Morris was responsible. Morris' friend and associate, Thomas J. Cobden-Sanderson, designed bindings noteworthy for the dignity with which geometrical figures and conventionalized patterns are combined. Cobden-Sanderson was one of the few hand binders who himself did not only the finishing but all the sewing and forwarding. Cobden-Sanderson's influence was great, not only through his own work, but through his pupils, among them Douglas Cockerell and Sarah T. Prideaux.

In the United States most of the outstanding binders, such as William Matthews and Alfred de Sauty, have been men who were born and trained abroad. They brought to this country the best European traditions and standards of workmanship.

With the turn of the 20th century the note of "modernism" appears in binding design as in other forms of decorative art. The student of bookbinding will be impressed, just as will the student of typography, with the fact that design in binding follows the general trend of other arts. Modernism in binding is comparable to the same trend in furniture or in architecture. Bookbinding is one of the fine arts, and like other fine arts reflects the spirit of its time.

HOW GILT IS PUT ON EDGES



When the finisher is ready to apply the gilt, he first places the book or books firmly in a press. Any slight irregularities in the edges he removes by scraping with a sharp knife which looks like the blade of a carpenter's plane (Fig. 1). Next he applies the glaire, which acts as a paste. Laying on the gold leaf (Fig. 2) requires great skill, because the leaf is so thin that a sudden breath of air may crumple it. The gold leaf is picked up in a small frame as shown in the picture. After the glaire is dry and the gold is set, the last step is to burnish or polish the gold (Fig. 3).

Steps in the Making of a Modern Book

WHAT are the steps in making a printed book?

When a printer plans to issue a new publication, he first prepares a "dummy," showing the paper to be used, the size of the page, the thickness and binding of the volume, and probably also showing several specimen pages set in the type to be used. Typesetting is now done almost entirely by monotype or linotype machines (*see* Linotype; Monotype). After the "proof" is corrected by the printer and the author, the type is made up into pages and sent to the electrotyping rooms, where copper plates of each page are made (*see* Electrotyping; Stereotyping). New proofs of these electrotyped plates are made and minutely scrutinized, so that any defects may be corrected. Then the plates are "locked up" in "forms," ready for the press.

The arrangement of the plates in the form presents an interesting problem. When you read a book, the page numbers, of course, follow one another in consecutive order; but that is not the way they were printed. The best way to get a clear understanding of how the pages are "laid out" is to take a large sheet of paper, rule it off and mark it as shown in Fig. 1.

Put the black numbers on one side, then turn the paper over and on the reverse side of each square write the corresponding light number. Be sure to write the numbers upside down when the plan calls for it.

Now fold the sheet across the middle horizontally, keeping the number 1 outside and uppermost; then fold it again vertically; then once more horizontally; and once more vertically, in each case keeping number 1 on the outside of the fold and uppermost. You will then have a little book of 32 pages, and if you cut its folded edges at the top, the right-hand side, and the bottom, and leaf through it, you will find that the pages are all right side up and in the correct numerical order.

Many variations of this plan are possible so as to make up "signatures" as they are called of 4, 8, 16, 32, or 64 pages. If you examine the ordinary loosely bound book at the back you will usually be able to distinguish the signatures fastened together side by side.

In Fig. 2, the inset shows a single electrotyped plate. The rest of the picture exhibits a locked-up form containing 64 such plates. The plan for this one is ingenious. The 32 pages making up one end of the

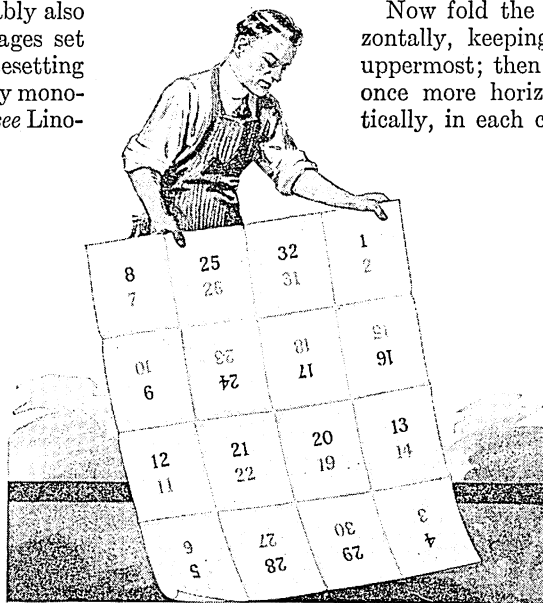


Fig. 1. How Pages Are Printed on a Sheet

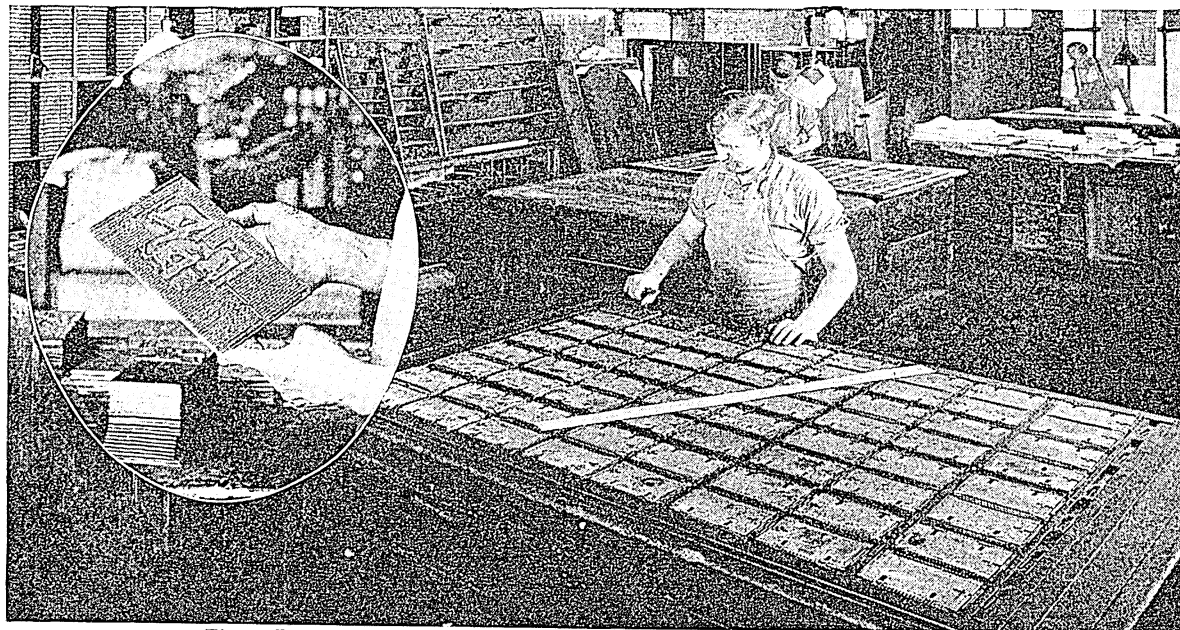


Fig. 2. Locking Pages into a Form and (in oval), an Electrotyped Page Plate

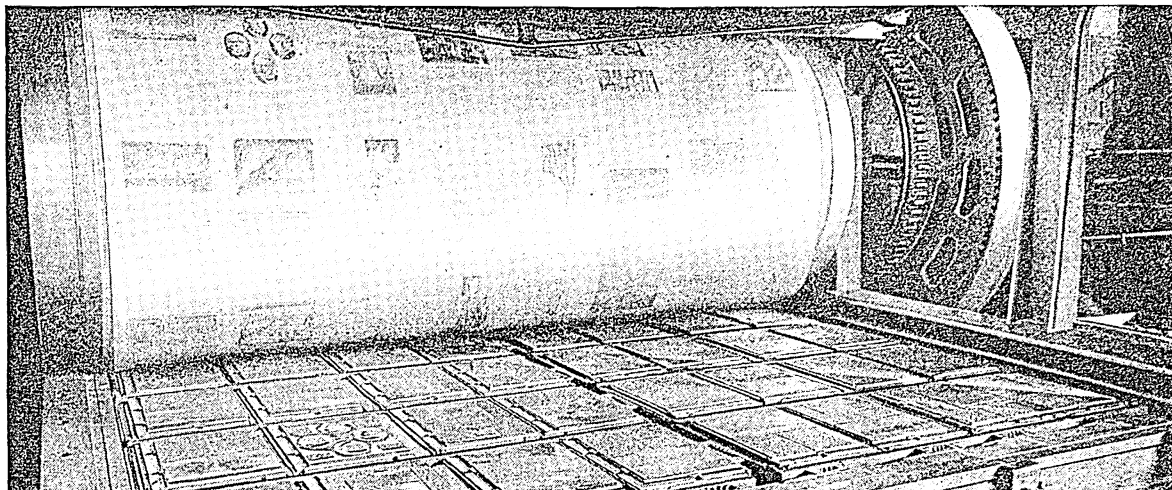


Fig. 3. A Printed Sheet Coming from a Form on a Flat-Bed Press

form are those that must appear on the *back* of the corresponding 32 pages at the other end of the form. If, then, a sheet of paper printed on this form on one side is turned over *end-for-end* and printed on the other side, all of the 32 pages first printed will now be properly "backed up" by the opposite 32 pages. The printer then has two identical signatures on his sheet, which he cuts apart in the middle, folds, and puts into separate volumes.

How a form is actually printed on a sheet of paper is shown above in Fig. 3. The form lies on the "bed" of the press. This bed moves forward and backward, while the paper is being fed into the machine over the large cylinder which revolves constantly. When the type bed moves back, the cylinder is raised so that it does not touch the plates. At the same time the plates are run under a set of inking rollers, made of an elastic composition, which spreads out the ink evenly over the printing surface.

In the picture above at which you are looking you see a press at the moment

that the inked plates have finished their forward movement, leaving their impression on the sheet. In the lower picture (Fig. 4) the printed sheets are coming through, at the back of the press, at the rate of 1,200 sheets an hour, and are being carried over the rollers and tapes to the delivery table or platform at the bottom. When a sufficient number of sheets has been deposited on the table, it is carted away to let the sheets dry in a warm room. After the sheets are dry, they are run through the press a second time, to print them on the other side.

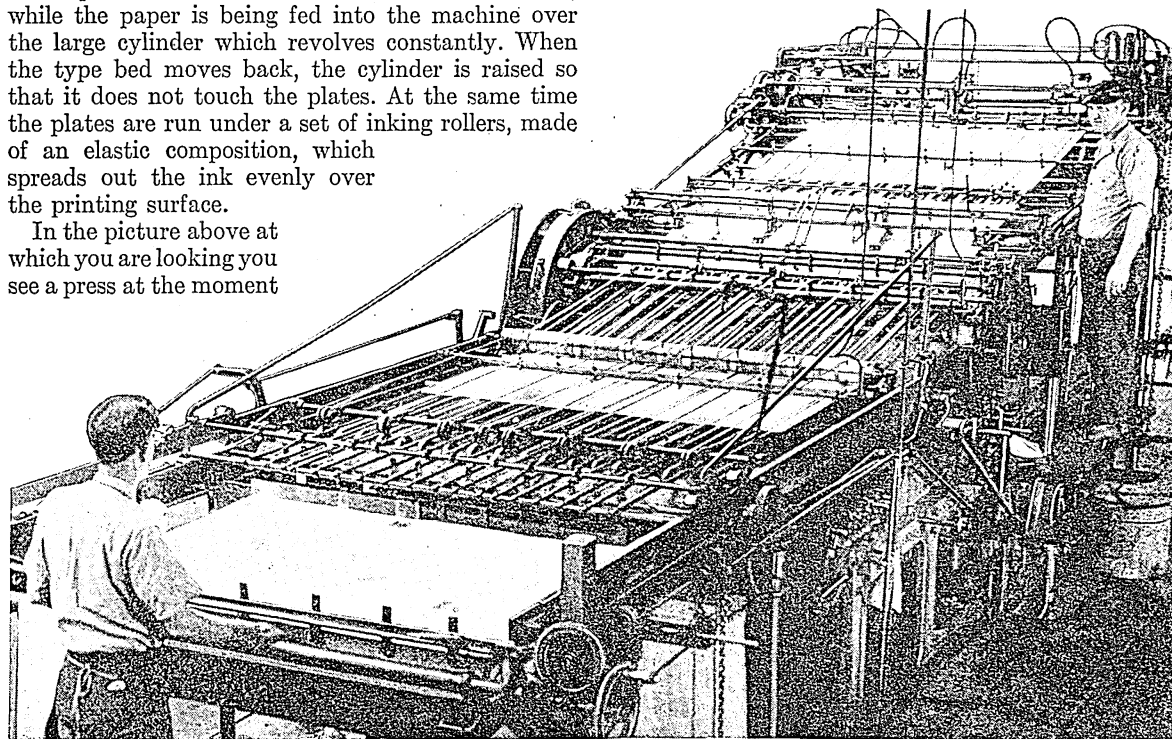


Fig. 4. Delivery of the Printed Form from the Press

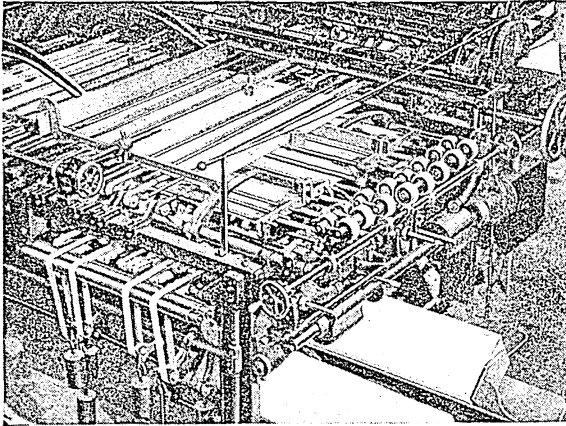


Fig. 5. The Folding Machine at Work

Next the sheets are cut and folded in the folding machine (Fig. 5). You can see the blunt folding knife at the end of the long curving arms, and below the folded signatures being delivered in V-shaped troughs. Such a machine as this one can fold signatures totaling 160,000 pages an hour.

After being folded, the signatures are "gathered." At the back of the gathering machine you can see stacks of signatures, each stack containing one signature. The clasping fingers of the machine take a

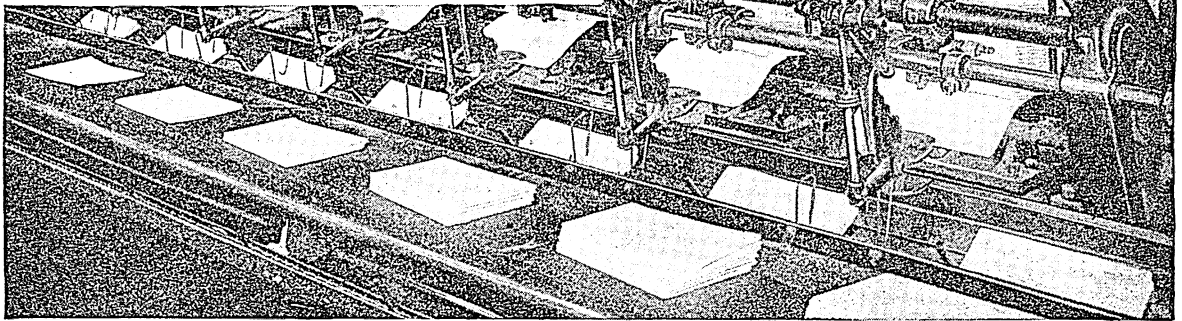


Fig. 6. The Machine that Gathers the Signatures

signature from each stack and lay it on the moving belt at the front. As that belt moves, it carries the signatures one space at a time, so that signature

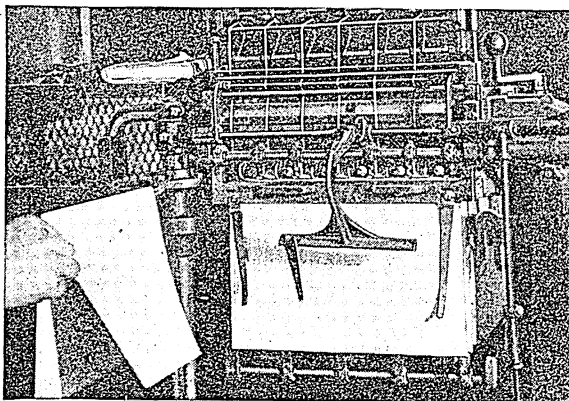


Fig. 7. Stitching Together the Pages of the Book

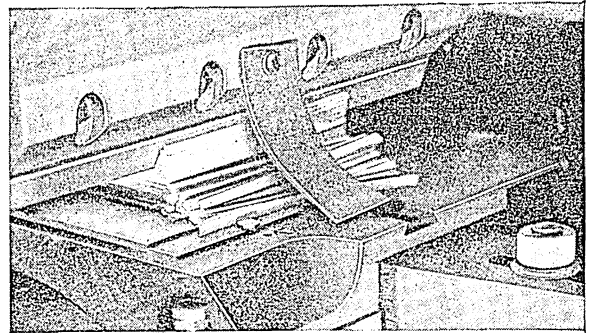
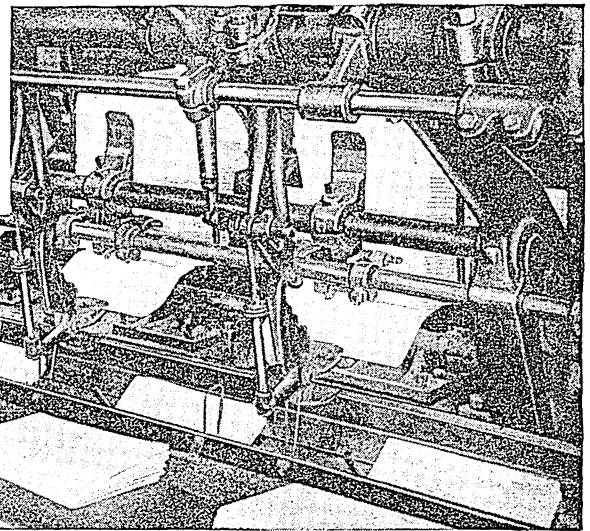


Fig. 8. The Trimmer Cutting the Book to Size

No. 2 falls on No. 1, No. 3 falls on No. 2, and so on, until at the end of the trip, at the right end of the picture (Fig. 6), each pile has one copy of each signature in the volume. The piles next go to the stitching machine (Fig. 7). In stitching, the signatures are picked up one by one by the operator, set astride the



carrier arm, and fed into the machine, which sews each signature to the preceding one and also stitches each signature through the middle.

The sewed volumes are then "smashed" in hydraulic presses (Fig. 9) under a pressure of 500,000 pounds, to squeeze out the air between the pages, and then the rough or folded edges are sliced off in the trim-

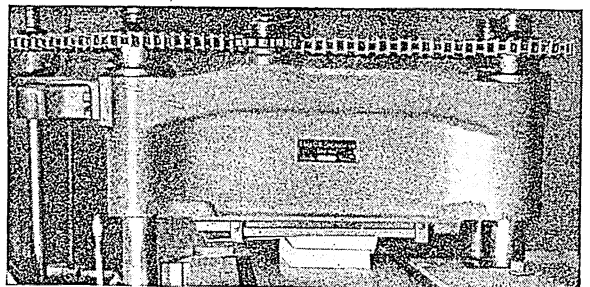


Fig. 9. The "Smasher" Compressing the Book

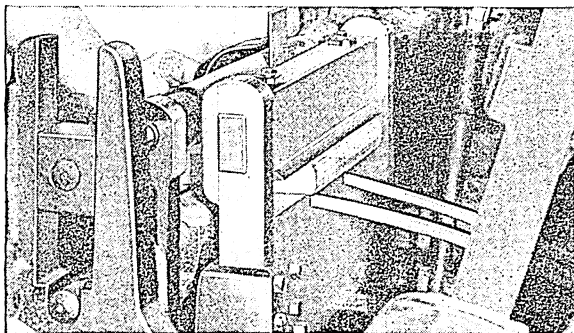


Fig. 10. Giving the Book's Back Its Rounded Shape

ming machine (Fig. 8). Sometimes the edges are not trimmed; the book is then "uncut." Trimmed edges may be left plain, or they may be sprinkled, marbled, or gilded. Sprinkling is now commonly done with an air-gun or air-brush. Marbling is done by dipping the edge of the book in a vat of oil colors which have been spattered into a pattern resembling marble.

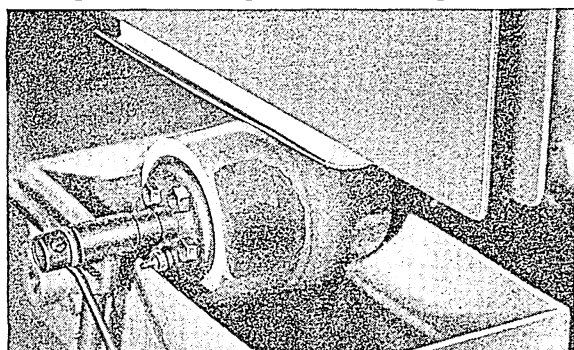


Fig. 11. Gluing the "Super" to the Back

After the volumes are sewed and trimmed, a thin coat of glue is applied to the backs, which are then rounded (Fig. 10). Another machine glues a strip of starched cloth, called a "super," to the back, with the edges of the super overhanging so that they may be

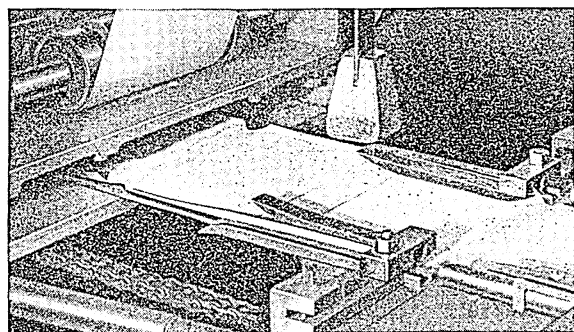


Fig. 12. Making the Book's "Cases" or Covers

glued to the boards of the case or binding (Fig. 11). A headband of striped cambric is then attached, and end-papers or linings are added. The volumes are then ready for the cases, which have previously been made by other machines (Fig. 12). These machines assemble

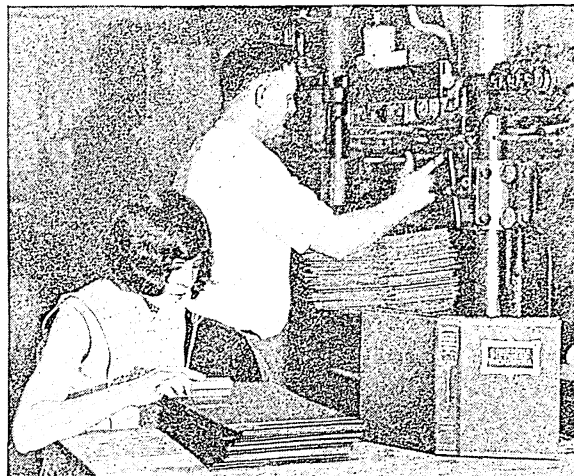


Fig. 13. How High-grade Gold Stamping is Applied

the heavy paper boards, place linings on the inside of the backs, cover the boards with cloth, turn in the edges of the cloth, run the cases flat through a wringer, and deliver them ready for the outside decoration. The lettering or decoration is put on by brass dies in heavy presses (Fig. 13).

Lastly the edges of the super are pasted to the inside of the cover boards. If the back is to be "tight" or "flat," the covering is glued directly to the rounded

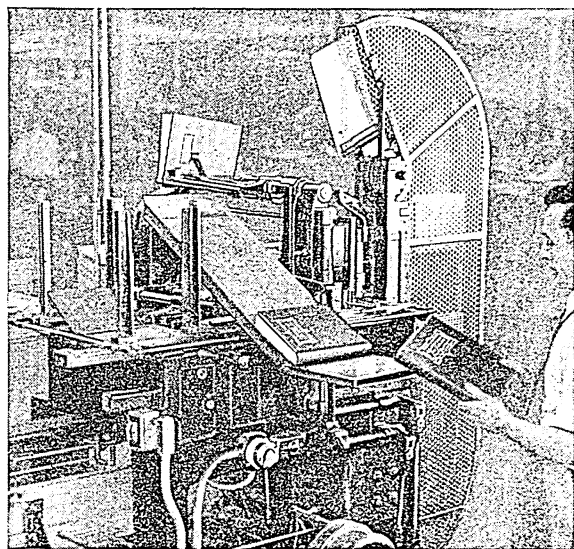


Fig. 14. "Hanging" the Book in Its Case

back of the book; a "hollow" back, such as the binding found on most novels and textbooks (Fig. 14), allows the back to remain free and rounded, with a space between it and the sheets when the book is open. The inside of the cover is then covered with a doublure, half of which is pasted to the cover board and the other half forms an end-paper. Doublures are usually of paper, but in expensive hand-bound books may be of leather or silk.

History and Principles of Book Collecting

THE collecting of books for personal libraries, as distinguished from the formation of libraries for reading or study, is a modern development. In ancient times and in the Middle Ages, there were a few collectors, but usually they were scholars, or rich men who bought books for the use of the scholars and students who frequented their houses.

The great English and French collectors, such as Grolier and deThou in France, Cranmer, Archbishop Parker, and Sir Robert Cotton in England, assembled collections of the books of their times which they considered worthy of preservation. Had it not been for such collectors, many of these books would have perished. Hundreds of them, now of little value for their texts, were bound in the choicest leather by the best binders of the day. In England almost all the large collections formed before the 18th century were bequeathed to colleges and universities. The great royal library, formed by the kings and queens, was given by George II to the British Museum when that institution was opened in the year 1759.

Collectors of Today

By this time there had also grown up a class of collectors described as bibliomaniacs or bibliophiles. The bibliophile, or lover of books, as the name means, has a sentimental interest in his collection. Some collectors specialize in "association books," which may have been presented by the author to a friend or may have belonged to a famous man or woman. A book which may not be worth ten cents as a text may be worth several hundred dollars if it has on its title page the autograph of George Washington or Abraham Lincoln. Many collectors also buy books for the beauty of the printing or binding. Most collectors today make a hobby of "first editions." Later editions may include additions and corrections which improve the text, but the first edition is presumably the form in which the

author approved his creation, and is thus closer to him. Because of the demand, first editions even of contemporary writers, often bring astonishing prices.

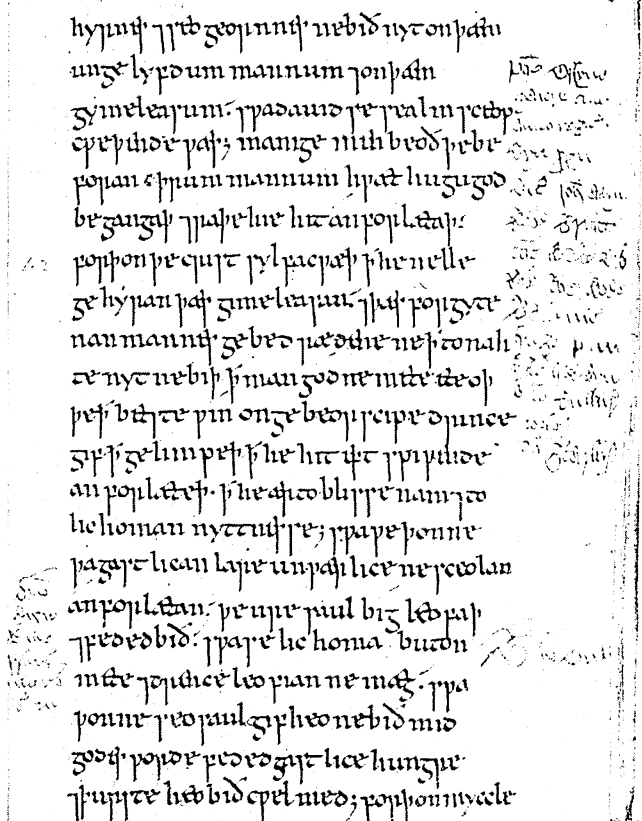
The first editions of many books were once actually in the hands of the authors, and in this way actually acquired a sentimental interest. Laurence Sterne, for

example, signed his name on the fly-leaves of many of the volumes of 'Tristram Shandy'. Or again, the book may have an interest such as attaches to Thoreau's first book, 'A Week on the Concord and Merrimac Rivers'. The publisher was able to sell only a few copies of this book, and finally shipped all the unsold books to Thoreau at Concord. Thoreau stacked the books in his room, and wrote in his journal, Oct. 28, 1853: "I have now a library of nearly 900 volumes, over 700 of which I wrote myself. Is it not well that the author should behold the fruits of his labor? My works are piled up on one side of my chamber half as high as my head." Nine years later, just after Thoreau's death, another publisher took all these unsold copies, had the old title pages torn out and new ones pasted in. Thus every copy

with the new second edition title page was really a copy of the first edition, and had been a part of Thoreau's "library" for nine years.

For book collectors today there is only one safe rule: collect the books *you* like. No one collector can hope to complete even a small field. Many of the great rarities are in permanent public collections, and will not again be offered for sale. Many other rarities are so costly that only millionaires can hope to acquire them. But any collector, even of modest means, can assemble a collection which reflects his own interests and personality. For the beginner there are many books of helpful hints written by collectors or book dealers or librarians. Catalogs of reliable booksellers, as well as those of auction houses in the larger cities,

ONLY ANGLO-SAXON MANUSCRIPT IN AMERICA



The Blickling Homilies, a collection of sermons by an unknown author, dates from the second half of the 10th century. It took its name from the family seat of the Marquess of Lothian, in whose possession it had been for generations before its sale at auction in New York by the American Art Association in January 1932.

give much useful information. Each year records of auction sales in the United States and in England are published, giving the prices at which the more important books were sold. There are numerous

The earliest known book plate was used in a Carthusian monastery in Germany about 1480. During the next 50 years German book plates reached a high degree of artistic excellence. Many of the foremost

SOME FAMOUS BOOK PLATES—ENGLISH AND AMERICAN



The collection of book plates of famous men is an interesting hobby. Such book plates are often of greater value than the books in which they have been preserved, and like the books themselves they are an expression of the owner's personality. George Washington's book plate is an example of good heraldic design.



magazines primarily for collectors, and there is even a published list of collectors in the United States and Canada, with their addresses and notations of the subjects in which each is interested.

Book Plates

The easiest way to indicate ownership of a book is to write your name on the fly-leaf. Many famous people not only wrote their names, but also annotated their books with comments on what the author said. Charles Lamb, for instance, not only scribbled his comments in his own books, but also in books which he borrowed. Lamb's friend Coleridge wrote voluminous notes in many of the books which he read; many of these notes were really essays in themselves, and some of them have been published. Collectors of rare books, however, usually consider writing of any kind, unless by a famous person, as lessening the value of the book, whereas a book plate may even be considered an added attraction if it is an artistic one.

artists of the time, including Dürer, Cranach, and Holbein, designed them. The earliest French book plates were used about 1530, but the greatest French book collectors for a century longer preferred to have their arms or other devices stamped on the leather covers. The earliest known American book plate is a plain printed label with the owner's name, "John Cotton, his book," and the date, 1674.

Although the vast majority of famous book plates merely show the owner's arms (*see Heraldry*), many are pictorial, showing portraits of the owners, library interiors, piles of books, landscapes, and even allegories and mythological figures.

Book plates may be made by a great variety of processes. A printed label is cheapest, and suitable for any kind of book. Any of the photomechanical processes, such as zinc etching, or half-tone may be used, or for finer more costly plates the design may be engraved by hand on steel or etched in copper.

Bookselling and Publishing

THE first systematized production and distribution of books appeared in Egypt, especially in Alexandria, about two centuries before Christ, where the Alexandrine editors prepared manuscript texts of books. In ancient Greece, there was no organized book trade, although there is evidence that some people collected books at great expense and that books were sometimes sold at a stall near the market of Athens.

By the time of the Roman Empire, the publication of books was a well-organized business, with its center at Rome, and with trade connections with Athens, Alexandria, and all parts of the Empire, even as far distant as Britain. The smaller booksellers often made their own manuscript copies of the texts they had for

sale, but the larger dealers had copies written out by slaves. As many as 50 slaves at one time would be writing the same text from dictation. Many of the slaves were foreigners not thoroughly familiar with Latin, and naturally made blunders, so that variations and errors crept into the texts. These careless errors have caused modern editors and students much trouble.

The Roman book trade depended on the excellent systems of communication and transportation built up by the emperors, and relied for support on a wealthy, cultured leisure class. In the years of civil war and barbarian invasions, the book trade came practically to a standstill, until finally with the fall of Rome in 476 A.D. it disappeared.

When printing was introduced, in the latter half of the 15th century, printers were for the most part their own publishers and distributors. The risks of this new trade were so many that few men were willing to share them with the printer. First of all was the opposition of the scribes, who formed powerful guilds (see *Gilds*). When we realize that in Paris and Orleans alone, the two centers of French manuscript production, there were over 10,000 scribes, we can understand that they had great influence.

Most of the early printers were wanderers who sought a new location as soon as they had learned the art. The printer usually went to a strange community, sometimes even a foreign one where a different language was spoken. He had first to seek out local support. Then he would find a suitable house, for the old presses were kept steady by supports which reached from floor to ceiling. Next there was the problem of designing the type, the purchase or making of paper, and finally a decision as to what book to print. The printer's possible clients were the churches, monastic libraries, parish priests, schoolmasters, and students. General readers were of no importance in the 15th century.

A few of the first printers received aid from rich nobles. Some, especially in Italy, were supported by bishops and cardinals. Many of the monasteries in Germany and Italy established presses, and had monks trained in the new art by some itinerant printer, just as they also had trained scribes.

Early Publishing Done by Printers

The printers who prospered, developed a market for more books than they themselves could print. About 1480 books began to appear with statements that they were printed by one man at the expense of another. Anton Koberger, of Nuremberg, one of the greatest printers of the 15th century, not only printed several hundred books on his own presses, but hired printers in other cities to print for him. Johann Froben, the great printer-publisher of Basel, both printed books on his own account and published them at the expense of other printers.

Some of the early printers had associates who had nothing directly to do with the manufacture of books, but gave their names to the enterprise, either for the glory of developing literature or from some other motive, but seldom for profit. Writing in 1523 about Froben's business, Erasmus says that there were three methods by which Froben's books were placed on sale. Small books, on which the risk was not too great, he published himself; for more important books he secured the support of an outside capitalist, for whom Froben acted on a commission basis; the third method was to sell shares in the enterprise to other publishers.

Not until about 1650 was there a well-defined class of publishers at Frankfurt and Leipzig, which by that time had become the centers of the trade in succession to Venice and Rome. The publishers in these two German cities, where the great annual fairs were held, were agents or booksellers for printers in all parts of

Europe. About this time began the custom of exchanging books between publishers. One publisher, in order to sell his productions, took in trade an equal value of some other publisher's output.

The early printers had no problem of dealing with authors. Most of the books printed were works of the Greek and Roman authors, or of the church fathers. Many of the printers were their own editors, and some, like Caxton, made their own translations.

With the, possible exception of Aldus Manutius, Froben did more than any other printer to develop the scholarship of his time, largely by persuading Erasmus and other scholars to prepare his texts and correct proofs. Erasmus was then the acknowledged first scholar of Europe, and he was probably the first modern author to make money by his writings. At the same time Erasmus also followed the fashion which prevailed then and until the 19th century of soliciting gifts from rich friends. In asking for gifts of this character an author was not considered to be asking help for himself personally, but for literature.

Instead of paying an author in money, many publishers gave him books. Sometimes an author received a stated number of copies of his own book, which he could sell for cash, or could reserve for the patron who had accepted the dedication of his book.

Modern Publishing Methods

Some time in the 18th century the practise of issuing books by subscription, which seems to have originated in England, became general, not only for authors who wished to issue their own books, but for printers and even publishers who wished to be assured of support. Under this plan an author would receive advance payments from subscribers. When publishers and printers adopted this method, however, their custom was not to receive any money from subscribers until the books were delivered. The publication of books by subscription is now restricted principally to expensive sets and to books on art or science with a limited field of readers.

In continental Europe it is still the practise for publishers to send shipments of their books to dealers "on consignment" or "on sale." Especially in Germany, where the book trade is most highly organized, every small dealer receives a supply of the new books which he or the publisher thinks suitable for his stock. Usually twice a year, accounts are made up and the dealer pays for such books as have been sold. The remaining books are either returned to the publisher or are allowed to remain with the dealer for sale.

The publisher has three chief objections to the consignment plan; first, he can never be certain how many books shipped out by him are actually sold; second, books returned by the dealers are often soiled; third, the demand for them may have disappeared.

These objections led to the adoption of the present "net price" system in use in England and the United States, which dates from 1900. Under this plan the publisher fixes the net price at which the book is to be sold by the retailer; any bookseller who cuts the

GOING TO PRESS IN THE OLD DAYS AND IN THE NEW



What a contrast between the primitive affair shown in this picture and the great modern high-speed press in the picture on page 185. Gutenberg is showing one of the sheets from his press to Johann Fust, his associate who supplied him with money to carry on his work. This simple type of machine, which was merely a development of the old-fashioned cider or cheese press, remained in use without improvement for a century and a half. Only two pages of a large book, like the famous 42-Line Bible, could be printed at a time on such a press.

price runs the risk of having his supply of new books cut off by all publishers. In the United States the net price system was declared by the courts a conspiracy in restraint of trade. In effect, however, the American book trade is organized on this basis, and it is the practise of booksellers to sell books at the published prices.

From the published prices the publisher allows discounts to the dealers, the percentage of discount usually being larger for a larger number of copies. As the tendency has been to make these discounts smaller and smaller, it has become more difficult for the retail bookseller to make a living.

Royalties and Other Payments to Authors

The adoption of the net price system greatly simplified the relation of publisher to author. For several hundred years, if the publisher paid any money to the author, it was the custom to pay a lump sum. Often these amounts were pitifully small. Milton received £5 when he turned over the manuscript of 'Paradise Lost' to his publisher, and agreed to accept three additional payments of £5 when each of the first three impressions should be sold. A few authors who were especially popular in their own time received large sums. Alexander Pope is said to have cleared £8,000 by his translation of Homer, and Charles Dickens received thousands of pounds for the 'Pickwick Papers' and his later books.

An author now generally receives a royalty, that is, a percentage of the published price, on the basis of the number of books actually sold. An established author, whose popularity will assure the sale of enough copies

to make a profit for the publisher, may get 15 or 20 per cent of the published price for every copy sold. Even higher percentages have been paid in the case of novels which were "best sellers." A novel by a new, unknown author, on the other hand, will probably bring its writer not more than $7\frac{1}{2}$ or 10 per cent royalty, increasing to 10 or 15 per cent after 5,000 copies have been sold.

Formerly it was customary for an author to sell all rights to his publisher. With the development of the magazines, the radio, and motion picture, this practise has changed; now an author usually sells separately the book rights, the serial or magazine rights, the dramatic rights (if his book has possibilities for a play), the motion-picture rights, and finally he may even receive special royalties if parts of his music or play are broadcast over the radio (*see Copyright*).

Many authors prefer to deal through a literary agent, who sells the book and as many special rights as possible on a commission basis and relieves the author of all financial negotiations. A reputable agent assures the publisher of the dependability of the author.

Publishing an Important Business

Germany leads the world in the number of books and pamphlets published. In a normal year the output will be from 30,000 to 35,000 separate items, not including reprints of old books. In France the annual output runs to about 10,000, in Great Britain about 8,000, in the United States from 6,000 to 10,000 a year. The value of books issued in the United States in one year is well over a quarter of a billion dollars.

BOOMERANG. The most remarkable weapon invented by primitive man was the boomerang, used by the natives of Australia. It is made of hard wood bent into a curve over a bed of hot coals. It is from two to four feet long, flat on one side and rounded on the other, with a sharp edge. There are several kinds of boomerang—for war, for hunting, and for amusement—varying in size and proportion. The well-known “return” boomerang is chiefly used as a toy. Instead of going straight forward, it slowly rises in the air, whirling around and around in a curved line until it reaches quite a height, when it begins to fly back again and sweeping over the head of the thrower falls behind him. This surprising motion is produced by the action of the air on the bulging side of the boomerang. The other types are effective weapons because of their size and irregular motion, but they do not return to the thrower. The natives show remarkable skill in the use of this weapon; it is said that with it they can almost cut a small animal in two at ranges within 400 feet.

BOONE, DANIEL (1734–1820). The mighty hunter Daniel Boone tells us that “it was on the first of May in the year 1769 that I resigned my domestic happiness for a time, and left my family and peaceable habitation on the Yadkin River, in North Carolina, to wander through the wilderness of America, in quest of the country of Kentucky.”

When only a boy he had come with his father from his native state of Pennsylvania to their home on the Yadkin, on the frontier of North Carolina. Pioneer life suited the lad, and he early developed a passion for hunting and exploring. As early as 1760 he had begun his explorations and pushed his way as far as Boone's Creek in eastern Tennessee. Near this stream there still stands a tree bearing this quaint inscription: “D. Boon cilled a bar on (this) tree in the year 1760.”

Fired by the glowing description of his friend John Finley, who in 1767 had penetrated into the border regions of Kentucky, Boone and five companions set out to explore that country. He was absent from home for two years, during which time he was once captured by the Indians, his only companion was killed by them, and he lived for two months alone in the wilderness without bread, sugar, or salt.

When he returned home, Boone was anxious to move his family to Kentucky, which to him seemed a second paradise. He had become dissatisfied with life in North Carolina which was becoming too thickly settled to suit his wild nature, while Kentucky was a vast wilderness peopled only by the Indians. The fact that it was a “dark and bloody ground,” even to the red man, did not worry Boone, for he was entirely unacquainted with fear. He had learned the ways of the Indian, not only from his frontier experiences, but also when he accompanied Braddock on his disastrous expedition in 1755.

Boone's enthusiasm over Kentucky was contagious. Because he had confidence in himself he

was able to inspire it in others, and he persuaded five other families besides his own to move west. At Cumberland Gap they were attacked by the Indians and six of their party were slain. Two years later, in 1775, they succeeded in reaching their destination, on the Kentucky River, and established Boonesborough.

During the Revolutionary War Boone rendered valuable aid to the settlements of Kentucky by his courage in repelling Indian attacks. At one time he was captured and carried to the English post at Detroit where he was adopted into the Shawnee tribe. When he learned that an attack on Boonesborough was being planned, he escaped, traveled 160 miles in four days, and bore a conspicuous part in defeating the Indians.

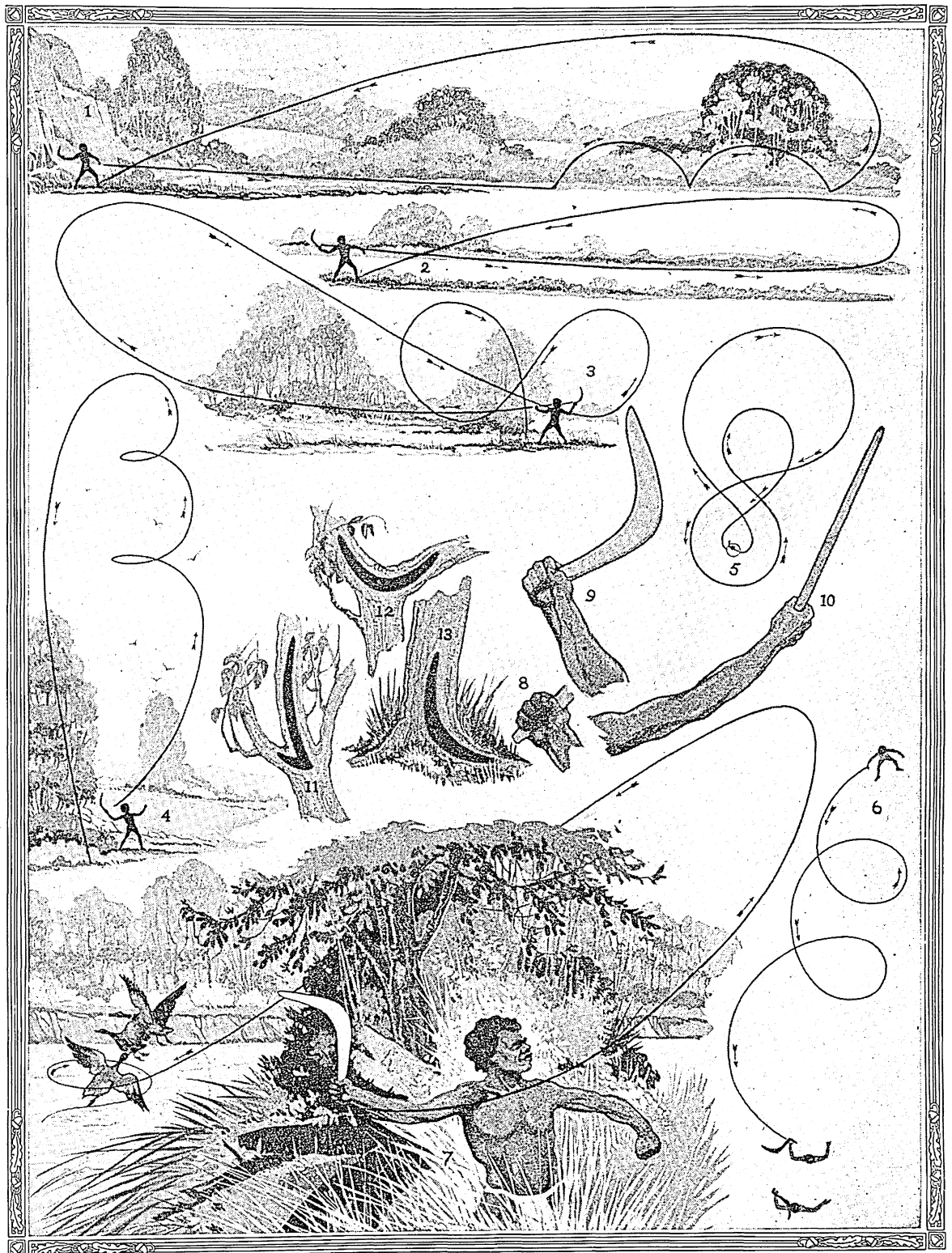
Boone always had a great contempt for law and lawyers, and as a result he neglected to secure the legal right to his land. This led to the loss of all of his possessions when the state of Kentucky was formed. Disgusted with a country which so poorly repaid his services, he crossed the Mississippi River and settled in Spanish territory 45 miles west of St. Louis, in 1795. When this region likewise came into the possession of the United States, through the Louisiana Purchase, Boone was again dispossessed of vast estates, owing to the fact that he had not taken the trouble to go to New Orleans to get his title confirmed by the representative of Spain. His lands in Missouri were later returned to him by Congress, because he had “opened the way for millions of his fellow men.” There he died, in his 87th year, surrounded by his children and their descendants—some of them in the fifth generation.

BORAX. Wherever the mineral borax is found in large quantities there once stood an ancient lake of bitter-tasting water. Then the climate changed and the lake dried up, leaving a glittering layer of white crystals, covered later perhaps by mud or dust. But not enough rain ever came after that to wash the borax away. So today the world's supply of borax comes chiefly from waterless deserts.

Borax is a mineral form of the salt that chemists call sodium borate ($\text{Na}_2\text{B}_4\text{O}_7$). It is a mild alkali useful as a “water softener” in kitchen and laundry work. Borax powder on hot metal melts to a glassy liquid which dissolves oxides and other surface impurities. For this reason it is widely applied as a flux in brazing and welding. Borax is used also in the manufacture of heat-resisting glass such as that used in making pyrex baking dishes and electric-lamp bulbs; of enamels for bathtubs, cooking utensils, and other metalware; of glazes for pottery and paper; and of food preservatives, antiseptics (including boric acid) and leather dressings.

The largest sources of the world's borax today are the deposits of almost pure sodium borate, called *kernite* or *rasorite*, in the Mohave Desert, Calif. They have to a great extent replaced the less pure deposits of *colemanite*, *ulexite*, and *tincal* in Death Valley, Calif., in Chile, and in Tibet. The potash brines of Searles and Owens lakes in

WHAT AN AUSTRALIAN CAN DO WITH A BOOMERANG



The Australian blackfellow can make his boomerang do many things. In No. 1, he shoots it ahead of him so that it strikes the ground, makes two loops and then one grand loop back to his feet. In No. 2, it sails through the air and comes back again without touching the ground. In Nos. 3, 4, and 5, it is executing various other air maneuvers more complicated than those of an airplane stunt pilot. No. 6 shows how a boomerang with a hook at the end can be made to catch on the shield of an opposing warrior and hop right over at him. In No. 7 a native is bringing down a duck on the other side of a tree. In Nos. 8, 9, and 10, a strong right hand grips different types of boomerang correctly. In Nos. 11, 12, and 13, we see how various shapes are cut from trees.

California yield some borax as a by-product, and some is extracted from salt lakes and marshes of Turkey and Italy.

Borax and boric acid (H_3BO_3) are among the few important compounds of boron, a hard, semi-metallic element (see Chemistry, Table of Elements).

The *borax bead test* is used in chemical analysis to identify unknown metals. Borax on a small platinum loop is heated to a glassy bead, touched to the substance to be analyzed, and reheated. The bead turns a certain color depending on the metal present—green for chromium, blue for cobalt, yellow for iron, and so on.

BORDEAUX (*bôr-dô'*), FRANCE. One of the leading seaports of France and chief city of the department of Gironde, Bordeaux lies on a plain on the left bank of the Garonne River. Its commanding position as a seaport is due to the fact that it is near the south of France, and hence conveniently located for trade with West Africa and South America. It is 60 miles from the sea, and near the point where the Garonne and the Dordogne meet to form the Gironde River.

The city is famous for its wines, which are exported in large quantities. Other valuable exports include hides and skins, sugar, rice, cotton and woolen cloth, fish, fruits, and vegetables. A large fishing fleet goes from Bordeaux to the Grand Banks each year.

As far back as the Roman Empire, Bordeaux was a flourishing city, called "Burdigala." Protected by its secluded position from the attacks of sea raiders, and lying out of the path of the early invaders, it long sheltered the last glimmers of Roman culture when the rest of France had entered the Dark Ages.

In 1152 Eleanor of Aquitaine married Henry of Anjou, and when he became Henry II of England in 1154, the Bordeaux region passed under English control for three centuries. In the 14th century the Black Prince held his court there. Bordeaux was not pleased when it again became French property at the end of the Hundred Years' War, and the French king clipped its privileges and imposed a salt tax.

The harbor is divided by the Pont de Bordeaux, a noble bridge of 17 great arches, one of the most famous in the world. The city boasts many fine old buildings. Notable among them are the Cathedral of St. André, dating from the 11th century; the Grand Théâtre; and the church of St. Michel, whose bell tower, 354 feet high, is the loftiest in the south of France. Bordeaux has been an educational center for many centuries and is the seat of a university founded in 1441. It is the birthplace of Montaigne, the essayist; of Rosa Bonheur, the painter; and of Montesquieu, the political philosopher.

The government of France was moved from Paris to Bordeaux during the Franco-Prussian War and during the World War of 1914–1918 when the German forces threatened Paris. Again during the second World War, when Germany invaded France in 1940, it became the provisional capital for a short time, after the government's flight from Paris and from Tours. It suffered a destructive air raid by German bombing planes. After the surrender of France it was occupied by Germany, and was bombed by the British Royal Air Force. Population, about 260,000.

BORDEN, SIR ROBERT (1854–1937). The Right Hon. Sir Robert Laird Borden, prime minister of Canada from 1911 to 1920, was born in the historic village of Grand Pré, Nova Scotia, on June 26, 1854, of a family which had been in Nova Scotia since 1760. After an education in the schools of his native province, he became a barrister; and he rose rapidly to a place of great prominence in the legal profession of Nova Scotia.

As with so many others in Canada, law proved with him a stepping-stone to politics. In the general elections of 1896 he was elected a member of the Dominion House of Commons for Halifax—a constituency which, with but one intermission, he continued to represent until 1917. From 1896 to 1911 the Conservative party, of which he was a member, was in opposition. His great ability, nevertheless, impressed itself on the country; and in 1901 he was chosen leader of his party in the House of Commons. For ten years he fought an uphill fight against heavy odds; then in 1911 he reaped his reward when the Conservative party swept the country in opposition to a trade reciprocity agreement with the United States. On the resignation of Sir Wilfrid Laurier, the Liberal leader, Mr. Borden was asked to form a cabinet; and he thus entered on a prime ministership which coincided with perhaps the most critical and glorious period in Canadian history.

During his first few years as prime minister, Sir Robert Borden (he was knighted in 1914) was much hampered by the opposition of the Liberal majority in the Canadian Senate; but as soon as the outbreak of the World War brought a truce to party strife, he got a chance to show the quality of his statesmanship. On the declaration of war he offered to the mother country Canada's whole-hearted support; and his guidance of Canada's destinies during the difficult but heroic years that followed entitles him to a very high place in the honor roll of the British Empire. Starting with an expeditionary force of 33,000 men, he did not stop until he had placed before the Canadian people the goal of 500,000 men as Canada's contribution to the struggle. When the need for men grew acute, he asked parliament to adopt the principle of compulsory military service; and in order to carry this measure in the country, he formed a coalition with the "conscriptionist" wing of the Liberal party. The general elections of 1917 amply justified his policy; and he was thus enabled to carry forward Canada's part in the war to a successful conclusion. The high reputation which the Canadian troops achieved in France and Flanders was due in part, at least, to the courage and wisdom shown by Sir Robert Borden. It is a fact of some significance that, among the prime ministers of all the Allied nations, Sir Robert Borden was the only one who directed the affairs of his country from first to last.

In 1917–19 Sir Robert Borden was a member of the Imperial War Cabinet, composed of five ministers of

the United Kingdom and the prime ministers of the self-governing dominions. Previously to this he had sat in the Imperial Cabinet, July 1915, the first occasion on which an overseas minister has ever participated in the deliberations of the Imperial Cabinet.

On the conclusion of the war, Sir Robert Borden went to Paris as the chief representative of Canada at the Peace Conference; and here he was mainly instrumental in obtaining for Canada and the other self-governing dominions of the British Empire due recognition as members of the League of Nations. By this time, however, the strain of his labors during the war and at the Peace Conference had told upon his health; and shortly after his return to Canada, he was obliged, for this reason, to relinquish the duties of prime minister. In the summer of 1920 he resigned and retired to private life, handing over the reigns of power to one of his lieutenants, Mr. Arthur Meighen.

Temperamentally Sir Robert Borden was not inclined to lend himself to the minor arts of the politician; but his achievement in accomplishing the formation of the Union Government in 1917, in the face of strong opposition within his own party and upon the basis of according equal representation therein to one wing only of the Liberal party, required remarkable gifts of patience, perseverance and firmness of purpose. He did not possess the oratorical gifts of Sir Wilfrid Laurier, and his speeches upon the public platform were characterized by earnestness of appeal to reason rather than by eloquence. Throughout the war he acted with great promptitude and vigor as occasion demanded.

Not many statesmen have made fewer mistakes than he made. With his scrupulous honesty, his conscientious caution, and his sound judgment, he gave Canada during the years of the World War an administration of well-balanced statesmanship.

BORGIA (*bôr'jă*) FAMILY. Of all the princely houses of Renaissance Italy, none was more powerful between 1455 and 1504 than this family of Spanish origin, which gave two popes to Rome (Calixtus III, 1455-1458, and Alexander VI, 1492-1503), and which in Caesar Borgia (1476-1527) supplied the perfect

type of the coldly calculating, unscrupulously wicked Italian tyrant.

Alexander VI frankly used his office to build up the power and fortunes of his children, whom he openly acknowledged. Trickery, war, poison, and the dagger were freely used to advance the family interests, though historians now disbelieve most of the tales of subtle and secret poisonings attributed to Alexander and his son Caesar as beyond the chemical knowledge of that time. The almost royal power of Caesar Borgia practically ended when his father was fatally stricken at a banquet in 1503, and he himself was temporarily incapacitated by a mysterious illness, which their contemporaries attributed to poison which they had placed for their enemies.

Caesar's sister, Lucretia Borgia (1480-1519), was represented by later writers as a veritable monster of wickedness. But she is now believed to have been "more sinned against than sinning," and a mere tool in

the hands of her unscrupulous family. In her later life as duchess of Ferrara she showed herself a woman of beauty, grace, and gentle manners, as well as a beloved patron of artists and scholars.

St. Francis of Borgia (1510-1572), a later member of the Spanish branch of the family, attained fame of quite a different sort as the pious and able head of the Jesuit Order.

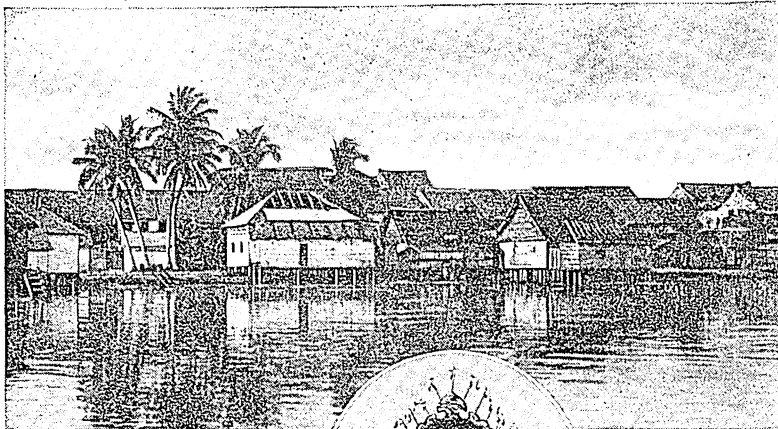
BOR'GLUM, GUTZON (1871-1941). Of rugged Danish ancestry, Gutzon Borglum was born in Idaho and educated in Nebraska when the West was still the "frontier." To this early environment he owes the bold imagination of his sculpture. To his training in Paris, under Rodin's influence, he owes his fine technique. Noteworthy examples of his work are the national memorial on the face of Mount Rushmore, South Dakota, with its gigantic heads of Washington, Jefferson, Lincoln, and Theodore Roosevelt; a head of Lincoln in the Capitol at Washington; 'The Centaurs' in Newark, N.J.; and 'The Mares of Diomedes' in the Metropolitan Museum, New York City. He designed the Confederate Memorial on Stone Mountain, Georgia, but the work was stopped after a disagreement with the sponsors. His brother, Solon Hannibal Borglum (1868-1922), was also a distinguished sculptor.

CANADA'S WAR PREMIER



Sir Robert Borden won international distinction as Canada's Premier during the World War, and as chief representative of the Dominion at the Peace Conference. Throughout those troubled days he was conspicuous for far-sighted ability and energy.

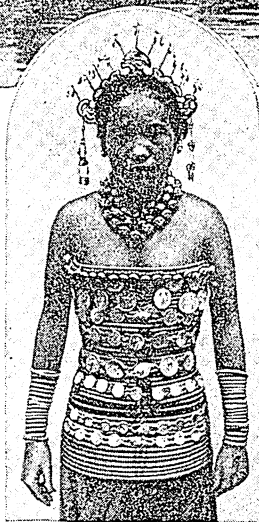
The VAST and SAVAGE ISLAND of the DYAKS



BORNEO. If you visit the Dyaks, one of the primitive peoples who live along the jungle rivers of the island of Borneo, in the Malay Archipelago, you will sleep in a huge barnlike structure built above the ground on high stilts, with a great cluster of smoke-blackened humanskulls grinning down at you from the rafters. For the Dyaks feel they honor a visitor by lodging him in this "head house," where they keep the heads they have cut from the bodies of their slain enemies. The roofs of their "long houses," 600 to 700 feet long, are steeply pitched to withstand the torrential rains, for Borneo, with an average fall of 150 inches, is among the wettest places on earth. Head hunting has been suppressed among the tribes living near the coast, but in the dense jungles of the interior, some wild tribes still practise the grim rite.

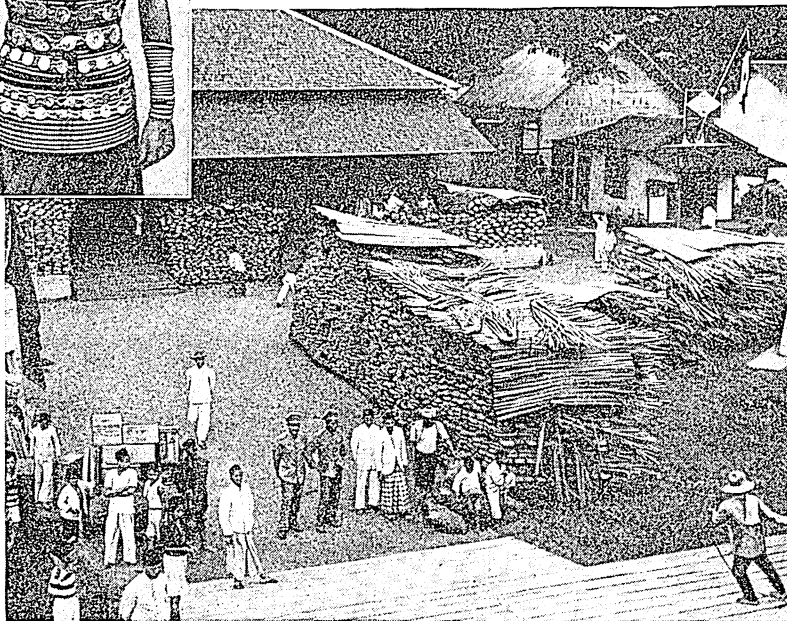
The Dyaks are the original "wild men of Borneo." They are still ghost-worshiping semi-savages who seek guidance for important projects from omen-birds, usually hawks, or read the will of their pagan gods in the entrails of sacrificed pigs and fowl. Over their queerly tattooed brown skins they wear only the scantiest of coverings, for the climate is oppressively hot.

The Dyaks are divided into many tribes, but Borneo natives are generally classed as Dyaks and Lauts, or Sea Dyaks, meaning inhabitants of the coast. The latter, mostly Mohammedans, are also called Ibans.



Other tribes are the Kayans, Kenyahs, Kalabits, Klemantans, Muruts, Dusuns, Bajaus, Punans, and Ukits, mostly pagan peoples. The Ibans are the most warlike and industrious. The most primitive tribes are the Punans and Ukits, who subsist on jungle foods, mainly wild sago, and by hunting, and live in the dense forests in shelters made of sticks and weeds. Rice is the staple food of the more advanced tribes.

Borneo, with an area of more than 290,000 square miles, is the third largest island in the world, exceeded in size only by Greenland and New Guinea. It is 800 miles long and 600 miles wide at its longest and widest points. North of it are the South China Sea and the Sulu Sea. To the east are the Celebes Sea and the Strait of Macassar, and the Celebes and Sulu Islands; to the south, the Java Sea and Java; and to the west the South China Sea and Sumatra, the Karimata Strait and the Malay Peninsula.



Behind the waterfront homes of the upper picture, built on stilts 15 to 20 feet above the muddy water, rises the roof of a typical Bornean "long house." In the next picture a Dyak beauty proudly displays her collection of native jewelry, consisting mainly of brass and copper rings strung on rattan. Below, we see the wharf of Pasir, one of the seven ports of Dutch Borneo, where rattan is exported.

From an airplane this vast island looks like one great emerald patch of jungle, with ridges of four forest-clad mountain chains traversing it irregularly from north to south. Mount Kinabalu in British North Borneo is the highest peak, reaching over 13,500 feet. Threading the mysterious forests—some still unexplored—are many silvery rivers dotted with small

trading boats and fishing canoes. These rivers are the highways of Borneo. The natives ply the rivers in swift boats called "prahus," or "proas," outrigger craft which sail just as well forward or backward because both stem and stern are pointed and the mast is amidships.

In the gloom of the great forests are ironwood, teakwood, ebony, and other valuable trees which form the country's chief natural resource. Camphor trees, fan palms, coconut palms, and



The magnificent physique of this Murut pack coolie makes light of heavy loads and mountain climbs.

many delicate ferns also abound. Through tangled jungles stalk the wild Malay ox, the tusked pig, the honey bear, the rhinoceros, and the elephant. The orang-utan, that powerful, human-looking ape called by the natives *maias*, the "jungle man," and the gibbon, a monkey that looks even more like a man than does the orang-utan, swing through the lofty trees. Along the branches at night dart the flying fox and the flying frog. Crocodiles haunt the rivers, and these, with snakes and lizards, make Borneo an

important source of reptile skins. The many streams swarm with edible fish.

The largest and richest part of this huge island is Dutch Borneo, with more than 2,165,000 people and 207,000 square miles. The most developed is the western district, which has three-fifths of the population and about a third of the area. Pontianak, seat of a sultanate, is the port and trade center. Bandjermasin on the Barito River exports the coal and rubber of south Borneo. Balikpapan is the refinery center for the petroleum of east Borneo, and Samarinda is the chief port.

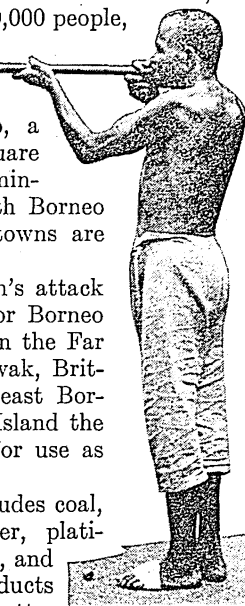
Sarawak and North Borneo became British protectorates in 1888, and Brunei in 1898. Sarawak, with an area of some 50,000 square miles and about 600,000 people, was long under the rule of "white rajahs." In 1839 Sir James Brooke, an Englishman, helped the Sultan of Brunei to put down a revolt, and was made rajah of Sarawak in 1841. His heirs continued to rule until the

Japanese conquest (1941). Kuching is the capital; other towns are Sibü and Miri, an oil port. The Japanese also seized the old sultanate of Brunei, with its 2,500 square miles and 30,000 people,

and British North Borneo, a district of about 31,000 square miles and 270,000 people, administered by the British North Borneo Company. The principal towns are Sandakan and Jesselton.

A major reason for Japan's attack was to obtain petroleum, for Borneo is one of the chief sources in the Far East. Oil is found in Sarawak, British North Borneo, and in east Borneo. On near-by Tarakan Island the petroleum is pure enough for use as a lubricant without refining.

Other mineral wealth includes coal, iron, gold, diamonds, silver, platinum, tin, mercury, rock salt, and porcelain clay. Its chief products are spices, nuts, camphor, gutta-percha, sago, rattan, and numerous tropical fruits, such as pineapples and bananas. Sugar cane, coffee, cotton, rice, and tobacco are cultivated along the coast and rivers. Rubber tree plantations now provide more than a third of the export trade. Agriculture is the main occupation; boat building, weaving, iron working, and the making of baskets and mats from bamboo and rattan are leading industries. The population of Borneo is about 3,000,000.



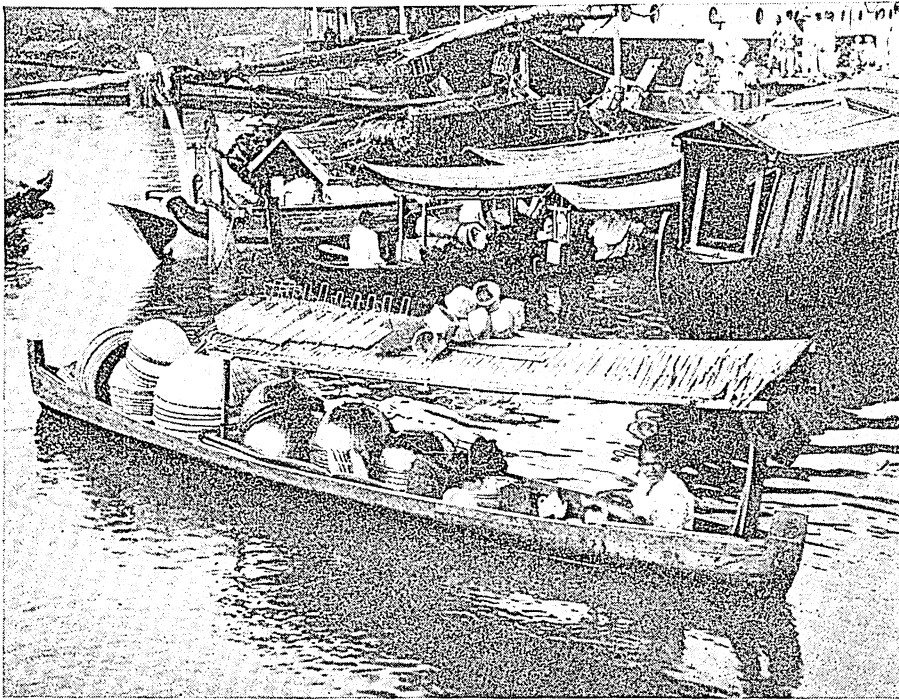
In the hands of the Borneo native, the blow-gun is a deadly weapon. Little poison-darts can be blown as far as 70 yards.

THE ENTERING WEDGE OF CIVILIZATION



Good schools are maintained in the coast cities of Dutch Borneo. But most of the pupils are Malays, like these little girls from Banjermasin, whose ancestors settled on the island in the 14th century. The Dyaks do not yet appreciate book learning.

RIVERS CARRY MOST OF THE INLAND TRAFFIC



As busy as the canals of Venice are some of the streams of Borneo. Here, near the mouth of the Barito River, is Banjarmasin, one of the most important trading centers in Dutch Borneo, with about 65,000 inhabitants. The boat in the foreground is loaded with huge umbrella hats of fiber.

Chinese traders are supposed to have visited Borneo first in the 7th century. Magellan's crew appeared there in 1521 after Magellan's death. The British and Dutch attempted to exploit the island in the 17th century with little success. Borneo natives along the coast turned pirates and preyed upon shipping for many years, but the British ended their piracy about 1845, and native rulers granted them a foothold in North Borneo. The Dutch also returned, but concessions to the British kept them out of the north. Dutch and British established long disputed boundaries in 1891. (For map see East Indies.)

BOS'NIA AND HERZEGOVINA. In Sarajevo, capital of the Austrian province of Bosnia, was fired the first shot of the World War of 1914-18—the shot that snuffed out the lives of the Austrian archduke Franz Ferdinand and his wife, and started hostilities between Austria and Serbia (see World War of 1914-1918).

Bosnia and Herzegovina, lying in the extreme northwestern portion of the Balkan Peninsula, and comprising less than 20,000 square miles—about twice the size of Vermont—have had a stormy history. They were a part of the Roman Empire, but after the barbarian invasions

they belonged at one time to Hungary, at another to the Serbs, and again they were independent. In the 15th century, with the rest of the Balkans, they fell under the power of the Turks, and there they remained until, at the close of the Russo-Turkish War of 1877-78, they were handed over to Austria. After the first World War they became part of Yugoslavia (see Yugoslavia).

Most of the region is high and mountainous with fertile valleys and great forests. Agriculture is the principal occupation. Sugar refining and rug making are among the few manufactures. The chief exports are iron, timber, and dried fruit.

A third of the 1,900,000 inhabitants are followers of Mohammed, and both the Roman Catholic and the Greek Orthodox churches have many adherents. In official Austrian documents the people were called "Bosniaks," but they themselves would not use the name. Racially, they are chiefly Croat and Serbian.

BOSPORUS. The river-like strait of the Bosphorus (or Bosphorus) is hardly less famed than the famous

city of Constantinople (Istanbul), which commands its southern entrance. It lies between the Black Sea and the Sea of Marmara, and forms part of the dividing line between Europe and Asia. Treacherous currents and fogs around the north end make navigation dangerous, and a number of lighthouses have been erected.

For a distance of 18 miles the channel of the Bosphorus, from one-third of a mile to two miles broad, winds in and out through a picturesque landscape lined with villages, ancient towers and forts, and lovely palaces and summer homes of residents of Constantinople.

The word "Bosphorus" comes from Greek words meaning "ox-ford," suggested by the legend that the goddess Io swam the strait in the form of a cow (see Io).

THE WHITE RAJAH



Sir Charles Vyner Brooke was the third white rajah of Sarawak. He succeeded his father. The three savage chiefs are Kayans from the interior of his domain.

HISTORIC BOSTON

*New England's
Metropolis*



BOSTON, MASS. Oliver Wendell Holmes, one of Boston's wittiest sons, once said: "Boston State House is the hub of the Solar System; you couldn't pry that out of a Boston man if you had the tire of all creation straightened out for a crowbar." Perhaps the Bostonian of today no longer believes that the hub of the universe visibly projects at the peak of Beacon Hill; but he has a pride in his native city, in its brave and romantic past, in its culture and literary traditions, in its splendid and prosperous present, which finds an echo in the hearts of all Americans. For here trod the Puritan fathers, John Winthrop and Cotton Mather; in Boston halls resounded the patriotic oratory of James Otis, the Adamses, and other Revolutionary leaders; and on every hand are memorials of Boston's notable part in America's history. So this fine and mellow old city, where the memories of three centuries survive undimmed in the midst of 20th century bustle and din, is a precious heritage to the whole nation.

The great gilded dome of the Massachusetts State House, like a ball of fire hung high in the air, is the most conspicuous object which meets the visitor's eyes, whether he approaches Boston by land or by sea. Ascend to the cupola which crowns the dome, and you will behold a scene never to be forgotten.

***T**HE anxious mariner off the rock-bound New England coast who detects through the night the flashing signal - - - - ("1-4-3") breathes a sigh of relief, for he knows that before him is Minot's Ledge lighthouse, and he has his bearings for the entrance to Boston harbor. Every 16 seconds this famous lighthouse sends forth to sea its signal of warning and guidance. Minot's Ledge is a sunken reef five miles off the Massachusetts coast. It was formerly one of the greatest dangers to navigation in the world, and the difficulties of constructing a lighthouse here were enormous. An iron structure built in 1849 was destroyed by a terrible storm within two years. Later, five years and endless pains were required to construct the present 88-foot granite shaft, whose stones are dovetailed and bolted together. This lighthouse is the key to Boston's sea-borne commerce, on which rests much of this great city's industries and prosperity. It may fittingly stand as the beacon light to guide us into the accompanying article.*

To the east your eye will sweep out over the island-dotted harbor, crowded with giant liners and freighters from across the Atlantic, with the smaller vessels that ply between the cities of the Atlantic coast, with ferries, fishing craft, and pleasure yachts. As you gaze north, west, and south, you will see what looks like one unbroken city, stretching as far as the eye can reach.

Boston itself covers only a small part of this district. Its area is about 48 square miles, but beyond it lies a succession of communities so closely built that the visitor cannot tell when he passes from one to another. Eighty cities and towns comprise the metropolitan district. In this region, which covers only 12 per cent of the state, live more than half of all the people of Massachusetts. It is one of the most densely populated areas in the country, with more than 2,200 people to the square mile.

About half of these communities, lying closest to Boston, share certain municipal services. Although they are independent governmental units, they have turned over to metropolitan commissions the regulation of their water supply, sewage disposal, parks, and their highways and other transportation facilities.

Memories of a Glorious Past

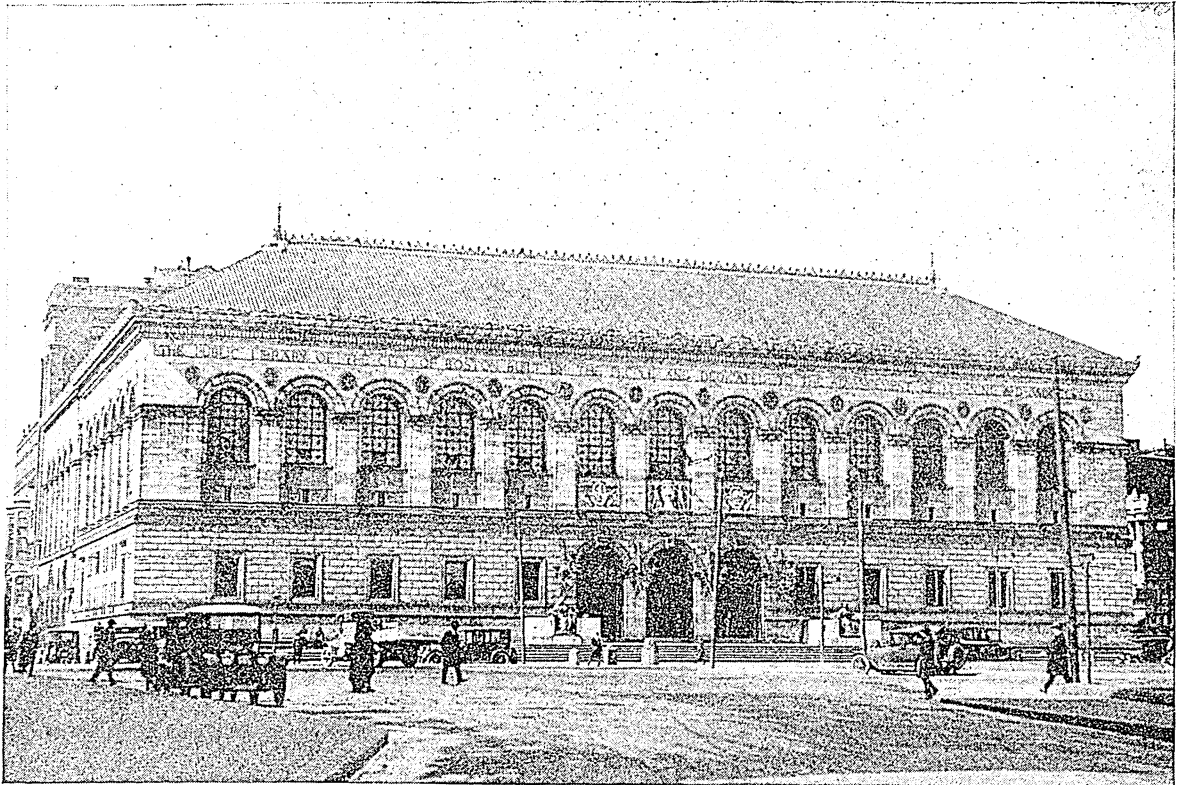
Now look more closely at the city which lies at your feet. What memories crowd upon the mind as

your eyes travel from one famous scene to another! Where else in America will you find so many relics of a great and glorious history, so many memories of illustrious men and illustrious deeds?

The State House where you have taken your stand is on Beacon Hill, not far from the center of the

Here criminals and Quakers were executed in the early days of Massachusetts Colony, here the British troops drilled before the battles of Bunker Hill and Lexington, and here the philosopher Ralph Waldo Emerson pastured his mother's cow, for up to 1830 the sedate folk of Beacon Hill used to send their

THE GREAT BOSTON PUBLIC LIBRARY



The Boston Public Library is built in Italian Renaissance style and surrounds an open court containing a fountain. Over the main entrance are reliefs by Saint Gaudens. The interior is decorated with mural paintings by Abbey, Sargent, Puvis de Chavannes, and other famous artists.

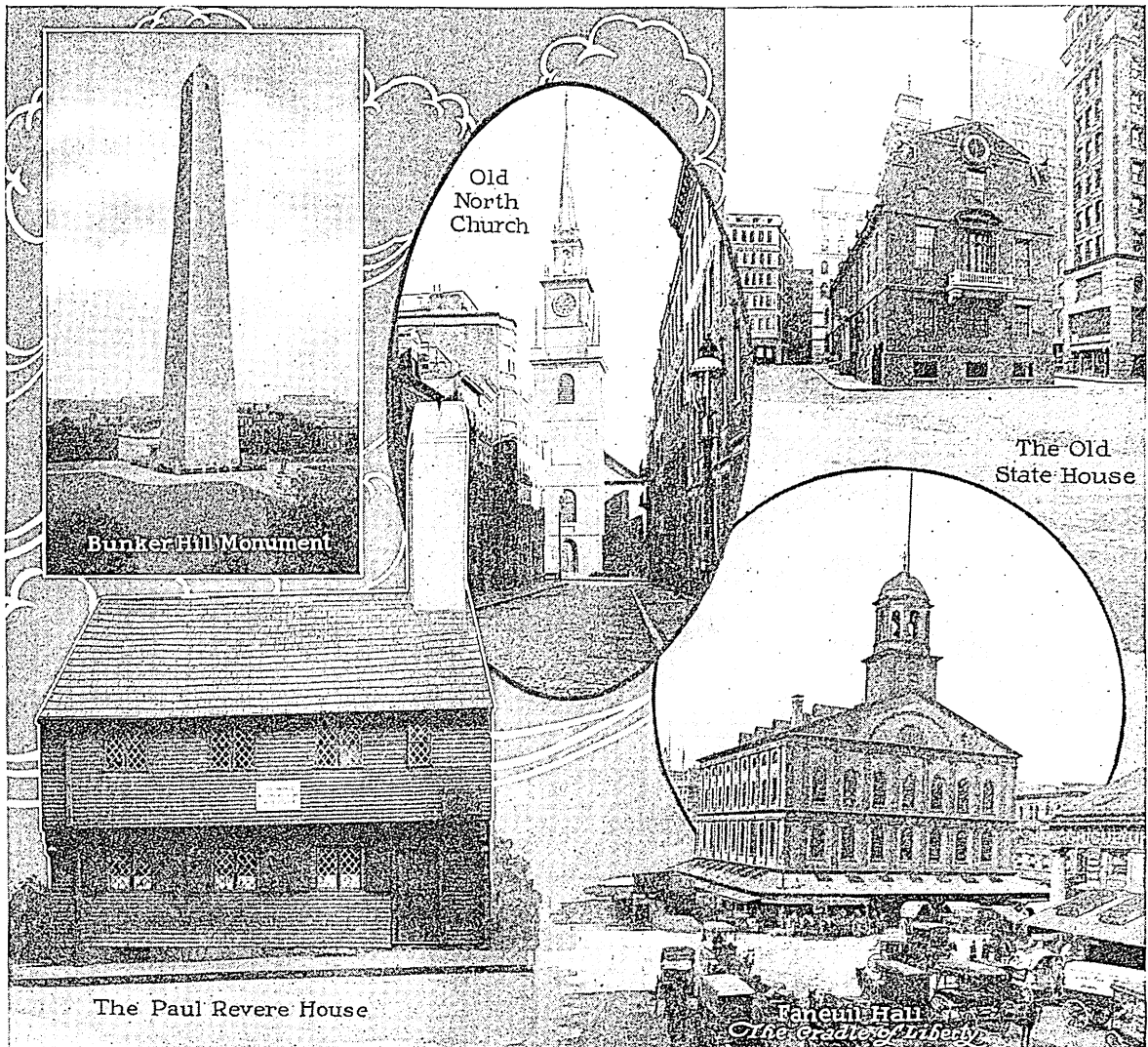
northward-pointing peninsula on which old Boston was built. Beacon Hill has been called the citadel of Boston aristocracy, for along its steep narrow streets are rows of serene and beautiful old dwellings in which have lived many of the men who have made American political and literary history. Here you may see the house in which the historian Parkman wrote for 20 years; in another Thomas Bailey Aldrich wrote his 'Story of a Bad Boy'; others have been the homes of Motley and Prescott; Ticknor and Alcott; Pinckney and Channing; Julia Ward Howe and William Dean Howells, and other famous persons.

Some distance beyond the foot of the hill to the west you see the beginning of the splendid wide embankment along the Charles River, which is one of the many notable public improvements of the last generation which have made Boston a place of beauty. To the southwest is the famous Common, a tree-dotted expanse of 48 acres in the heart of the city, with the smaller Public Gardens adjoining.

cattle to the Common to graze. Some of the famous men who often trod the Common in the days when the nation was in the making lie buried in the little Old Granary burying ground just to the northwest. There are the graves of Samuel Sewall, the parents of Benjamin Franklin, John Hancock, James Otis, and Samuel Adams.

Straight on past the Common and the Public Gardens along the broad Charles lies the fashionable Back Bay district, once a salt marsh but long since reclaimed at the expense of forests of timber, quarries of granite, and mountains of gravel. On the other side of the river you catch sight of the ivy-covered red brick buildings of Harvard University, lying in the heart of Cambridge, the most celebrated of Boston's suburbs (*see Cambridge*). Not far from the river is stately Commonwealth Avenue, 240 feet wide, with its strip of green parkway down the center adorned by statues of famous men. This is one of the links in Boston's famous park system, which girdles

HISTORIC SITES OF BOSTON



Of the many historic sites in and around Boston, some of the most interesting are here shown,—the Paul Revere house, the Old North Church from the spire of which tradition says the lanterns were hung on the night of that famous ride, the Old State House, Faneuil Hall, and the great granite shaft commemorating the heroism of the men who fought on Bunker Hill. The shaft is 221 feet high and inside of it is a stairway by which you can reach the summit.

the city with two rings of parks and playgrounds and boulevards so that there is no part of the whole metropolitan area without its breathing place. A few blocks south of Commonwealth Avenue is the scarcely less famous Boylston Street, with its many magnificent public buildings, churches, and hotels. About half a mile down it broadens into the green triangle of Copley Square, where you see one of the most famous groups of modern buildings in America. Here is the great Public Library, renowned for its beautiful design as well as for its huge collection of books. It is adorned with paintings by Puvis de Chavannes, Edwin Austin Abbey, and John Singer Sargent. Opposite the library is one of the finest examples of ecclesiastical architecture in America, Trinity Church, with its beautiful decorations and

stained glass windows by La Farge, William Morris, and Burne-Jones. Two other imposing structures adorn the Square, the Copley Plaza Hotel, built in 1911, and the New Old South Church. Boston University is a block beyond the square, and the famous Latin School, the oldest school in the country (founded in 1635), is a few blocks to the south. Along Huntington Avenue, one of the streets which meet at Copley Square, are many other notable buildings, among them Mechanics Hall, the mother church of Christian Science, Symphony Hall, the Opera House, and the Museum of Fine Arts, which has one of the world's greatest art collections.

Circling farther around the cupola to the south and east, you see at your feet the maze of narrow crooked streets that make up the business center. Washing-

ton Street is the most congested thoroughfare in the country, and several others are so narrow that traffic is permitted in only one direction. This, one of the oldest parts of Boston, is rich in historic buildings and associations. Here is the Old State House (1748), the seat of royal government of Massachusetts during the provincial period, now a historical museum. Under its balcony took place the fateful "Boston Massacre" of 1770, when five persons lost their lives in an encounter with the British soldiery. Not far away is Faneuil Hall (1763), the "cradle of American liberty," where the patriots often met during the Revolutionary period, and where in later times Webster, Choate, Sumner, Wendell Phillips, and Everett made the air ring with the thunders of their oratory. Old South Church, where Benjamin Franklin was baptized and where so many patriotic meetings were held that it gained the title of the "sanctuary of freedom," stands in the midst of a group of modern office buildings that far overtop its slender wooden spire. Tucked away in another corner is the old pillar-fronted King's Chapel (1749), where General Washington sat one day in 1789 when an oratorio was given in his honor. In the little burying ground adjoining are the graves of John Winthrop and John Cotton.

Looking northward to the site of the original city—now a crowded foreign district—you will make out the tower of Christ Church (also called Old North Church), the oldest church of the city (1723), whence it is supposed the lanterns were shown for Paul Revere's famous ride. Revere's house too is still standing, not far away, a little two-story building with a steep roof, almost lost among Italian shops and tenements. In Copp's Hill burial ground beyond Christ Church are the tombs of the Mathers.

Where Bunker Hill was Fought

Across the narrow dock-lined stretch of water, spanned by many bridges, that separates the North End from Charlestown, you see a plain square stone shaft rising high above the huddle of roofs. This is the Bunker Hill Monument, which commemorates one of the glorious episodes in American history. All the eastern end of the Charlestown peninsula is given over to the vast United States Navy Yard, which has stood here ever since 1800. At the piers or out in the open water lie scores of warships, little and big, contrasting strangely with the famous wooden frigate *Constitution*, or "Old Ironsides," as it is affectionately known. School children of the country gave their pennies to help make it a floating museum.

Such are a few of the historic scenes that crowd on your eye as it sweeps over the city. But however much we may like to dwell on the greatness of Boston's past, we must not forget the greatness of the modern city, the capital of Massachusetts, the metropolis of New England, and one of the country's richest financial centers. Though it ranks only ninth in population, it is fourth in wealth. Many powerful banks, railroads, insurance companies, mining concerns, and wholesale distributing houses make it their

headquarters; and it has its own stock exchange. Through the port of Boston pour raw materials to feed the mills and factories of a great industrial area. The city is the largest wool market in the world, one of the largest markets for hides and skins, and a leading port of entry for raw cotton.

Industries and Education

Boston importers supply raw materials for the textile mills of all New England. Boston itself and the metropolitan area have been textile centers since Colonial days. The manufacture of clothing and of textile machinery is also very important. The first skilled shoemakers came to the colony from England in 1629, and the industry was well established by 1650. Boston and its neighboring cities still produce more shoes than any other area in the world. Shoe-making machinery and leather are related products. Printing and publishing and the manufacture of electrical machinery, rubber footwear, and confectionery are among the many other industries. The Boston Fish Pier is said to be the largest in the world devoted exclusively to fish. More than 3,000,000 pounds have been landed in a day, and frozen and filleted fish are shipped in immense quantities.

As a seat of education, the Boston area is unsurpassed in America. In the city are Boston University, Simmons College, Northeastern University, Harvard Medical and Dental schools, and the New England Conservatory of Music. The Athenaeum Library and the Boston Museum of Fine Arts are world-famous institutions. Cambridge, just across the Charles River, is the home of Harvard, Radcliffe, and the Massachusetts Institute of Technology. Wellesley and Tufts colleges are in Wellesley and Medford respectively.

The largest of the immediate suburbs is Cambridge (see Cambridge). North of it, on the south bank of the Mystic River, is Somerville, the principal meat-packing center of the state. Arlington, Medford, Everett, and Chelsea lie along the north bank of the Mystic River. Everett manufactures coke and petroleum products, oils, chemicals, and shoes. Chelsea produces shoes, paper, and elastic webbing. Medford and Arlington are attractive residential suburbs. Southeast of Chelsea is Winthrop, and northeast is Revere, both celebrated for their beach resorts. Thrusting almost into the heart of Boston from the west is Brookline, a wealthy residential suburb. Newton, west of Brookline, is the seat of Boston College and of Andover Newton Theological School. Waltham, north of Newton, is famous for its watches. On the south Boston is touched by Dedham, Milton, and Quincy. The last is famous as the home of the Adams family. Shipbuilding is its most important industry.

A Colorful Historical Background

The history of Boston is in large part the history of Massachusetts. It was founded in 1630 by Puritan settlers led by John Winthrop, and was first called Trimountane, from its three hills. The name was soon changed to Boston, from the town in Lincolnshire, England, whence many of the settlers had come. The original name survives in "Tremont" Street. The city was a center of Puritanism and of learning

in America. Here were started the first newspapers (1690 and 1704). The same Puritan spirit which led to the punishment of heretics, Quakers, and witches contributed largely to making Boston the center of opposition to the oppressive measures of the mother country in the period preceding the Revolution. The Boston Massacre, the Tea Party, and the British evacuation of Boston are famous events. In the 19th century Boston retained its leadership in educational, cultural, and humanitarian lines. Many great literary men and scientists lived in or near the city, among them Longfellow, Lowell, Whittier, Emerson, Hawthorne, Holmes, Agassiz, Parkman, Motley, Prescott. The city also became the center of the anti-slavery movement.

In 1872 the city was visited by the greatest of several devastating fires which destroyed more than \$75,000,000 worth of property in the business section. In the rebuilding many of the narrow and winding streets were widened and straightened. For municipal improvements during the last generation, Boston stands in the first rank of American cities. It was a pioneer in the parks and playgrounds movements. It has 40 miles of berthing space, with one of the world's largest drydocks. An elaborate airport for commercial and military aviation was built as early as 1922.

Until the middle of the 19th century Boston retained its original racial character. But following the potato famine in Ireland there was a great influx of Irish to the United States and many found Boston, one of the chief ports of entry, so attractive that they remained there. Italians, Russians (mostly Jews), Poles, and Canadians have also altered the racial balance in recent years until now the New England stock is far in the minority. In this city founded by the Puritans, Roman Catholics now have the greatest number of churches. Jewish places of worship are second in number. Population of Boston proper (1940 census), 770,816.

BOTANY. It should be understood at the outset that botany is one division of biology, or the science of living beings, and that it simply means a study of biology with plants as illustrative material. The article on Plant Life deals in detail with the most important and interesting features of this subject. Here we consider merely the technical development of the science and its several subdivisions.

Men began to study plants to discover those that were useful to them for food, or in the arts, or in medicine. The first botanists were perhaps healers and priests looking for new drugs and magic charms. Aristotle and his pupil Theophrastus, in the days of the ancient Greeks, had classified all plants as trees, shrubs, and herbs, and there was no further attempt to develop a scientific knowledge of plants until the 16th century. It was then that students again began to arrange plants into groups, but the groups were artificial. These attempts culminated in the famous artificial system of the Swedish botanist Linnaeus, published in the middle of the 18th century and in use to the middle of the 19th century.

Since the days of Linnaeus a great advance has been made in constructing what are known as natural systems of classification, which attempt to put together those plants which are really related. As a consequence, the subject of classification, or *taxonomy* as it is called, is now upon a very substantial basis. Taxonomy is the oldest phase of botany and to many it continues to represent the whole subject. It is not unusual to meet people who think of botany as the analysis of flowers. Of course, taxonomy includes

the classification of flowering plants, but it includes a classification of all other plants as well.

What the Microscope Did for Botany

During the latter part of the 18th century a new phase of botany began to be developed, which deals with the structure and development of plants and their organs. This study became possible only through the invention and gradual improvement of the microscope, by means of which the minute structures of plants could be investigated. At first botanists interested themselves merely in the structure of mature plant bodies; but as there gradually developed the knowledge of the cell, as the basis of living bodies, the field of *plant anatomy* came into view. This has to do with the various cell aggregates known as "tissues" which enter into the plant body. Still later, botanists began to be more interested in the way in which the tissues are related to one another to form the plant body and its organs, and the science of *plant morphology* began to exist. This last subject for a time contented itself with the study of the forms of plants and their organs, but presently passed into the more important phase of studying the gradual development of plants and of their organs, subjects which are often called *embryology* and *organology*. Morphology not merely studies the development of structures, but it studies the relationships of plants which are thus revealed, and hence is interested in what is known as *phylogeny*, that is, the ancestral history of plant groups.

Plants at Work

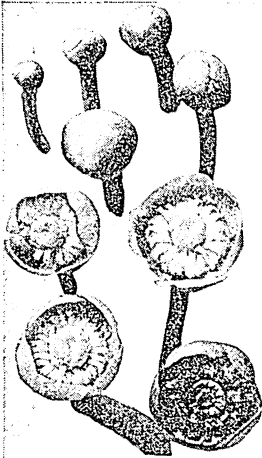
During the time that plant morphology was coming to the front, another view of plants was being developed, namely, that which deals with their life processes, or the plants at work. A good many botanists cared not so much for the structure of plants as for the activities of plants, and *plant physiology* began to assume importance. This subject developed with exceeding rapidity during the 19th century. It is certainly one of the most important views which can be taken of plants.

During recent years still another field of botany has come prominently forward, which deals with plants in relation to their environment, and is known as *ecology*. Under this phase the necessary relations of plants and their organs to light, heat, soil, temperature, etc., are studied, and also those exceedingly interesting communities known as "plant societies."

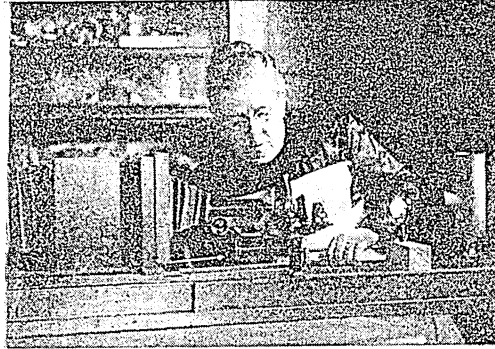
Most recent of all the phases of botany is *plant breeding*. This and animal breeding constitute *genetics*, the scientific study of inheritance. The plant-breeder, by hybridizing, selecting, and pedigreeing is able to produce new and valuable types of plants.

The foregoing may be taken to represent the principal fields of botanical activity today, but there are other botanical subjects which are of more special development. For example, *plant pathology* deals with the diseases of plants, *paleobotany* with fossil plants, *economic botany* with plants in relation to the interests of man, *forestry* with the problems of the proper

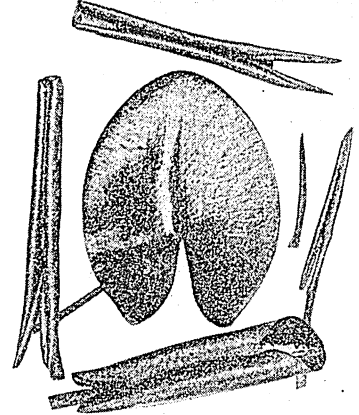
LOOKING INTO THE HEART OF A GROWING PLANT



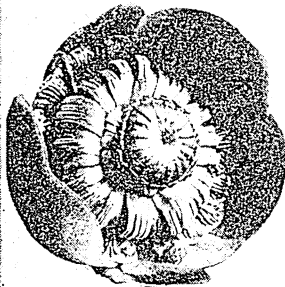
Here we see each stage of development from the new bud to the grown flower



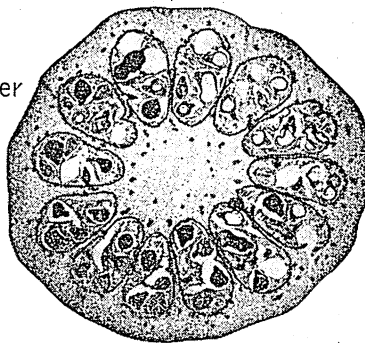
A botanist taking photomicrographs



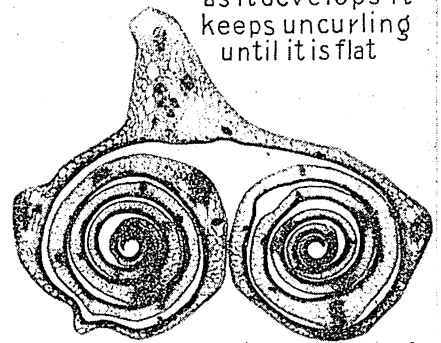
Watching a leaf "grow up" is interesting. This leaf is all curled up when born, but as it develops it keeps uncurling until it is flat



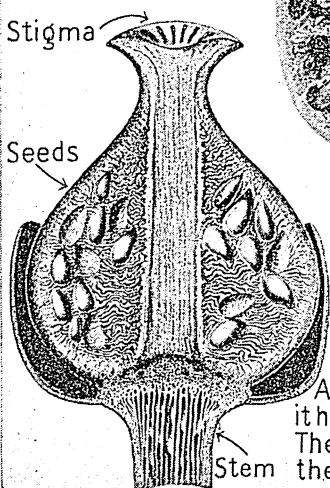
The matured flower opens up to receive the air and sunlight



The unripe fruit is here cut in half to show how the young seeds rest in their cradles



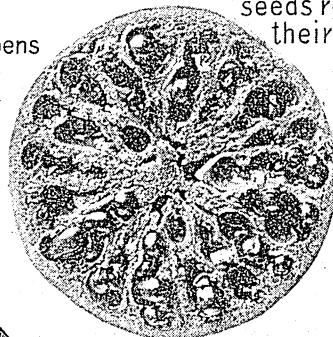
This magnified view of the leaf bud cut in half shows how it looks curled up



Stigma

Seeds

Stem

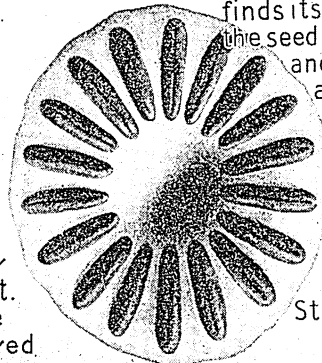


Here the seeds are old enough to drop out and take root

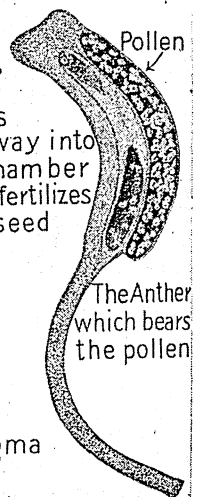
A peep into the pistil after it has ripened into the fruit. The stamens, having done their work, have disappeared

The stigma at the top of the fruit receives and holds the pollen grains, while each grain sends out a slender tube. This

finds its way into the seed chamber and fertilizes a seed



Stigma



The Anther which bears the pollen

Botanists study plants in much the same way as physicians study the human body. They cut sections of the delicate parts and examine them with microscopes, make chemical analyses of the plant's tissues, and so are able to give us the hidden secrets of plant anatomy. At the top we see the method by which botanists take greatly enlarged photographs of plants. A microscope is substituted for the lens of an ordinary camera, and an intense light is focused upon the part to be photographed. The remaining pictures, telling the structure and life history of the yellow Water Lily, illustrate the manner in which the thousands upon thousands of different plant species are "described," before they are given their rank and classification. These pictures not only show the plant's anatomy, but also how the flower develops from the tiny bud to the mature seed case.

cultivation and use of forests. Still further subdivisions of the general subject are common. A *bacteriologist* is one whose attention is devoted to the study of bacteria, those minute microscopic plants which cause many diseases and are important in other ways. The *phycologist* studies the algae; the *mycologist* studies the fungi, the *bryologist* is a student of mosses, etc.

A real elementary knowledge of botany should include something from all the principal divisions of the subject. For example, a beginning student should know how plants must relate themselves to

their surroundings in order to live (*ecology*). He should know how plants make food and use it, how they are irritable and respond to stimuli, and how they reproduce (*physiology*). He should also learn something of the essential structures of the great groups so that he may know the make-up of a toadstool, moss, fern, flowering plant, etc. (*morphology*). In addition he should have some general knowledge as to how plants are put into great natural groups or families, and he should be able to discover the names of the most important plants of his vicinity (*taxonomy*).

— REFERENCE-OUTLINE for Organized Study of BOTANY —

WE OWE our lives to plants, for they manufacture the world's food. Great peoples have perished, others have migrated and altered the whole course of history because their accustomed crops or their pastures withered under some change of climate. Plants provide the raw material for countless industries. An intelligent grasp of geography, of chemistry, of medicine, of the workings of our own bodies and the rules of health, of the influences that shape trade and commerce, tariffs, and conservation laws, indeed, of the whole course of our civilization past and present, is impossible without some definite knowledge of the laws and habits that prevail in the great kingdom of the plants. The following Outline will guide the reader in interesting and orderly fashion to all the essential information.

Classification of Plants

I. THALLOPHYTA: This subkingdom includes the simplest plants with "thallus" bodies, that is, bodies without true roots or leaves; the plant may consist of one cell or of many cells; reproduction by simple division or by spores developing apart from the parent plants.

Phylum PHYCOPHYTA: Algae (A-118); chlorophyll-bearing Thallophytes. All are aquatic or live in moist situations. Algae have been grouped, according to the coloring matter in their tissues, into:

Class **Myxophyceae:** Blue-green Algae. Example: Oscillatoria.

Class **Rhodophyceae:** Red Algae; mostly marine.

Class **Phaeophyceae:** Brown Algae. Examples: Kelps, Sargassum, Rockweeds (S-72, picture), Diatoms (P-245, picture).

Class **Chlorophyceae:** Green Algae. Examples: Pond Scums, Sea Lettuce (S-72, picture).

Phylum MYCOPHYTA: Fungi (F-218); thallophytes without chlorophyll, obtaining their food from other organisms, living or dead.

Class **Myxomycetes:** Slime Molds (S-163).

Class **Schizomycetes:** Fission Fungi; single-celled body. Includes all the bacteria (B-12, G-77).

Class **Phycomycetes:** Algaelike Fungi. Examples: Water Molds, often parasitic on fishes; Downy Mildews; Black Molds (M-170).

Class **Ascomycetes:** Fungi-Bearing Spores in Sacks. Examples: Yeast (Y-204), Morels (M-307), Truffles (M-307).

Class **Basidiomycetes:** Fungi-Bearing Spores on Structure Called "Basidium." Examples: Rusts and Smuts (R-199), Mushrooms (M-306).

Note: Lichens (L-122) are combinations of a *Fungus* and an *Alga* living together in a partnership that is mutually helpful.

II. EMBRYOPHYTA: Subkingdom of plants with separate stem, root, and leaf structures; reproduction through true embryo formed in the parent body.

Phylum BRYOPHYTA: Mosses and Their Allies (M-270). In this phylum primitive leaves, stems, and *rhizoids* (rootlike structure) first appear, yet the forms show alga-like characteristics; reproduction occurs by alternation of generations, the *gametophyte* (sexual generation) being the conspicuous form.

Class **Hepaticae:** Liverworts (L-166); green, flat, creeping (thalloid) body; found growing in moist locations; spore case opens by splitting.

Class **Musci:** Mosses (M-272); spore case has a lid.

Phylum PTERIDOPHYTA: Ferns (F-24) and Their Allies. In this phylum a *vascular* system first appears, that is, a system of vessels for conducting sap through the plant body; true roots, stems, and leaves are found; reproduction by alternation of generations, but the *sporophyte* (asexual generation) is the conspicuous form.

Class **Filicinaeae:** True Ferns (F-24).

Class **Equisetineae:** Horsetails or Scouring Rushes (R-177, F-26).

Class **Lycopodiinae:** Club mosses, Ground Pine, Candytuft, etc. (F-26).

Phylum SPERMATOPHYTA: Seed-Bearing Plants; including all the so-called "higher plants." Spermatophytes are sometimes called *Phanerogams* (from the Greek words meaning "visible marriage") to distinguish them from all the preceding plants which are *Cryptogams* (meaning "hidden marriage"); this distinction emphasizes the contrast between the plainly visible method of reproduction through seeds and the other methods which were formerly more difficult to trace and observe.

Subphylum Gymnospermae: Naked-Seed Plants, comprising Cycads and Conifers; Cycads (T-133) are tropical forms, resembling palms; Conifers are the familiar Pines (P-219), Spruces (S-264), etc.

Subphylum Angiospermae: Inclosed-Seed Plants (S-75); seeds produced within an ovary.

Class **Monocotyledonae:** Seeds Have Only One Cotyledon or Seed Leaf; leaves are parallel veined. Examples: Grasses and Grains (G-136), Palms (P-37), Lilies (L-136), Iris (I-132).

Class **Dicotyledonae:** Seeds Have Two Cotyledons; leaves are net-veined.

Subclass Archichlamydeae: Flowers have no corolla or one of separate petals. Examples: Willows (W-104), Oaks (O-189), Walnuts (W-5), Beeches (B-78), Pink family (P-221), Buttercup family (B-282), Water-lilies (W-47), Poppy (P-304), Rose family (R-156; pictures R-157), Bean family (B-65), etc.

Subclass Sympetalae: Flowers have corollas in which the petals are united, often forming a tube. Examples: Heath family (H-263), Primrose family (P-345), Gentian family (G-30), Mint family (M-195), Nightshade family (N-145), Composites—Daisy (D-5), Sunflower (S-330), Aster (A-338), Goldenrod (G-115), etc.

Plant Anatomy and Physiology

- I. STRUCTURE OF PLANTS: P-236.
- A. Units of Structure: Cell (C-121), Protoplasm (P-356).
—For structure of simplest plants, see *Thallophytes* in foregoing section of this outline; the following divisions apply to the higher plants.
- B. Roots:
- Kinds of Roots: R-153.
 - Internal Structure of Roots: P-238 (picture).
- C. Stems:
- Kinds of Stems:
 - Erect Stems: self-supporting. Trees (T-130).
 - Climbing Stems: Three types.
—Root Climbers: Ivy (I-176).
—Tendrils Climbers: Pea (P-90).
—Twining Stems: Hop (H-338).
 - Prostrate Stems: Strawberry (S-306).
 - Burrowing Stems or Rhizomes: May-apple (M-91), Iris (I-130).
 - Specialized Stems:
—Bulbs, Corms, Tubers (B-269).
—Succulent Stems: Cactus (C-10, A-291, picture).
 - Structure of Stems:
 - Monocotyledonous Stems (T-133).
 - Dicotyledonous Stems (T-133).
 - Bark (B-46).
- D. Leaves: L-88.
- Kinds of Leaves: L-89; distinguished by veins.
 - Form of Leaf:
 - Simple: Poplar (P-303).
 - Compound: Clover (C-281).
 - Arrangement of Leaves: L-89.
 - Structure of Leaf: L-88, L-90.
 - Flowers are Leaves Modified to Produce Seeds:
 - Structure of Flowers: F-120-127.
 - Structure of Seeds: C-368, B-66 (pictures).

II. GENERAL PLANT PHYSIOLOGY: P-234-244.

- A. Photosynthesis: How plants manufacture starches with the aid of sunlight and chlorophyll (P-237, L-88).
- B. Respiration of Plants: L-88.
- C. Nutritive Processes: P-236.
- In Roots, Stems, and Leaves: P-238.
 - Osmosis in Plant Tissue: P-237, P-239.
 - Conduction of Food Substances, the Chief Function of the Stem: T-131.
 - Storage of Plant Foods in Roots and Stems: P-244.
 - Transpiration or Release of Excess Water Through Stomata: L-88.
- D. Movements of Plants: P-241-242.

III. PLANT REPRODUCTION: B-112.

- A. Reproduction by Cell Division or Spores: C-121, S-75. The *Cryptogams* or Flowerless Plants do not produce seeds (see section on Classification of Plants). The *Thallophytes*, *Bryophytes*, and *Pteridophytes* are of this group.
- B. Reproduction of Flowering Plants: The *Spermatophytes* are also called *Phanerogams* in contrast to *Cryptogams*.
- Flowers: F-120-127.
 - Wind Pollination: P-297.
 - Insect Pollination: F-124. Fig (F-31), Yucca (Y-211), Orchid (O-243), Clover (C-281).
 - Self-pollination: P-297.
 - Seeds: S-73.
 - Distribution (P-241).
 - Germination of Seeds (B-66).
- C. Reproduction by Runners, Grafts, Slips: S-306, F-211.

Plant Ecology

Note: For this branch of Botany consult first the general article on Ecology E-145a-146.

- I. AUTECOLOGY: The individual plant in relation to its surroundings.
- A. Special Adaptations for Securing and Digesting Food:
- Insect-eating Plants: P-242-243.

- Parasitic Plants: Mistletoe (M-212), Dodder (P-70).
- Epiphytic Plants: A-95.
- Symbiotic Plants: Lichens (L-122).

B. Adaptations for Protection:

- Stinging Hairs: Nettle (N-75).
- Thorns: Barberry (H-270), Hawthorn (H-247).
- Spines: Thistle (T-81), Holly (P-240, picture).
- Poisonous Plants (P-272).

C. Adaptations for Seed and Fruit Dispersal:

a. By Wind:

- Tufted or "pappus" seeds: Dandelion (D-9), Milkweed (W-64).
- Winged Seeds: Elm (E-257), Maple (M-54), Ash (A-323), Pine (P-220).
- Dustlike Seeds: Poppy, Petunia, Snapdragon.
- Whole Plant carried by Wind: Tumbleweeds (W-64).

b. By Water which Distributes Floating Seeds and Fruits: Coconut Palm (C-292), Lotus, etc.

c. By Animals:

- Fruits equipped with barbs, hooks, etc., for clinging to fur and feathers: Cocklebur, Burdock (W-64).
- Fruits with fleshy covering eaten by animals who transport and drop undigested seeds (S-75).
- Fruits with hard covering (nuts) buried by squirrels, etc.

d. Explosive Types: Jewel Weed (W-64), Witch-hazel (W-128), Monkey's Dinner Bell (P-244, picture).

II. SYNECOLOGY: The Social Life of Plants:

A. Plant Associations:

- Hydrophytes: plants wholly or partially submerged in water (W-49); Rushes (R-177).
- Xerophytes: plants adapted to very dry air and soil, as in deserts (P-235 picture).
- Mesophytes: plants adapted to moderate conditions of moisture.

B. Plant Societies:

- Forest Societies: F-154, T-130.
- Prairie and Plains Societies: Grasses (G-136), Sagebrush (S-3), Prickly-pear Cactus (C-10), Cottonwood (P-304).
- Desert Societies: A-290, Cactus (C-10), Yucca (Y-211), Mesquite (M-121), Date Palm (D-18), Acacia (A-4).
- Arctic-alpine Societies: A-278, T-133, P-234, P-236. Lichens (L-122), Dwarf Willows (W-104).
- Fresh-water Societies: W-49.
- Marine Societies: O-200, S-72.

Economic Botany: Uses of Plants

I. SUBSTANCES MANUFACTURED BY PLANTS:

- A. Primary Products Essential to the Life of Plants:
- Starch, the Reserve Food of Plants: S-276.
 - Sugar, the Converted and Utilizable Food: P-240, S-322.
 - Cellulose, the Stiffening Material: C-123.
- B. By-products and Waste Products:
- Fats and Oils: F-19.
 - Gums: G-188.
 - Resins: R-78.
 - Alkaloids: A-10.
 - Tannins: L-83.

II. MAN'S USE OF PLANT SUBSTANCES:

- Food: F-140.
- Fibers: F-30.
- Lumber and Paper Pulp: L-212, P-56.
- Drugs: D-114.
- Perfumes: P-122, M-326, S-23.
- Dyes: D-121.
- Other Commercial Products: Vegetable Ivory (I-176), Rubber (R-163), Cork (C-365), Gutta-percha (G-190), Turpentine (T-165), Camphor (C-41).

RELATED SUBJECTS: For additional material related to Botany, consult the following Reference-Outlines:

AGRICULTURE BIOLOGY CHEMISTRY
INDUSTRIES and INDUSTRIAL ARTS

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BOTHA(bō'tā), Louis (1862–1919). "I want the king and the British people to realize that the trust reposed in us has been worthily taken up," said Gen. Louis Botha in 1910, when he became prime minister of the newly formed Union of South Africa under the British crown.

And yet the man who spoke these words had ten years before been commander-in-chief of the Boer forces in their disastrous war against Great Britain. Resisting to the last, when he saw that the cause of Boer independence was doomed, he made the best terms he could for his people; and in 1907, when the Liberal party in England gave the Transvaal self-government, he became the first premier.

In the World War, Botha rallied a Boer army to the Allied cause and compelled the surrender of all the German troops in Southwest Africa.

BOURBON, HOUSE OF. Intrigues and wars, marriages and assassinations, carried the autocratic house of Bourbon, founded in the late 9th century by doughty Adhèmar, first baron of Bourbonnais, to the thrones of France, Spain, and part of Italy. The rising tide of republicanism swept the last of the family from power more than a thousand years later, when gay, sport-loving King Alfonso XIII left Spain after a bloodless revolution on April 14, 1931.

Henry IV, with his white-plumed helmet flashing before his victorious troops, gained the throne of France in 1590 (see Henry, Kings of France). His successors, the Louises (see Louis, Kings of France) ruled the French with ever-growing arrogance until the Revolution brought weak Louis XVI and his frivolous queen, Marie Antoinette, to the guillotine. Restored to the throne after Napoleon fell, the French line ended with the abdication of Louis Philippe in 1848. Bourbon rule in Naples and Parma ended when their lands united with Italy in 1860.

The Spanish line began its 200-year reign when Louis XIV placed his grandson, Philip V, on the throne of Spain in 1700 at the cost of the frightful War of the Spanish Succession.

BOWLING. From the old outdoor English game of "bowls" has developed in America one of the most popular of winter indoor sports, bowling or "tenpins."

The English game is played on a smooth lawn. Players roll wooden balls (slightly unsymmetrical to make them curve) on a 40-yard course toward a white earthenware ball called the "jack" or "kitty." The player or team with most balls nearest the jack wins.

The American game is played on a smooth wooden floor or "alley," 41 or 42 inches wide. A gutter, 8½ to 9½ inches wide, extends along each side of the alley. At one end of the alley ten wooden pins stand in triangular formation, with their centers 12 inches apart. At the other end is a foul line, which the player must not pass. From the foul line to the Number 1 pin at the apex of the triangle the distance is 60 feet. The player rolls balls made of wood or some hard composition down the alley in an effort to knock down all the pins.

There are several varieties of the American game. The standard game is played with "bottle" pins 15 inches high and 11⅝ inches around their largest part. The balls are 27 inches or less in circumference, with finger holes to give a firm, but not cramped, grip. The players alternately roll ten innings or "frames" of two balls each. If a player in any frame knocks down all the pins with his first ball, it is called a *strike*, and the score for that frame will be ten, plus the total pins he knocks down with the next two balls he rolls. A *spare* is scored when the player knocks down all the pins with the two balls of any frame. It counts ten plus the total made with the first ball he rolls thereafter. Without strike or spare, the score of any frame is simply the actual number of pins knocked down. A spare in the last frame calls for an extra ball to determine the score; a strike, two extra balls. A perfect score consists of 12 successive strikes, totaling 300.

"Duck pins" is played with smaller bottle-shaped pins and with balls not more than 5 inches in diameter. The same sized ball is used in "candle pins," but the pins in this game are taller and more nearly cylindrical. A slightly smaller ball is used in "New England candle pins," and fallen pins or "deadwood" are allowed to remain in the alley. The standard scoring method is used in all these games. "Ninepins" was an old game, played without the Number 1 pin.

SKILL and STRATEGY in the RING

BOXING. The "manly art of self-defense" has long been the accepted description of boxing; and it is a manly art. Anyone who masters it must have self-control, strength, agility, endurance, and power to coördinate thought and action. More than any other sport, perhaps, boxing tests one's self-control; almost always the boxer who remains cool, who refrains from becoming excited, and who keeps his temper will out-point an opponent who "goes up in the air." In addition to the exercise that the sport affords, there is, of course, a large benefit in the self-confidence that it brings. The boy or man who has mastered the art of boxing knows that he can take care of himself in an emergency.

The proper time to begin learning to box is early in boyhood, for in this sport as in others the earlier the start, the more rapid the progress. The gymnasium floor or any open space indoors or out will serve as a boxing ring. The only equipment needed is two pairs of well-padded gloves.

The Queensberry Rules

Some of the rules which have made boxing a clean sport are these—all hitting must be done with the gloved fists; butting, kicking, and tripping are not allowed; wrestling holds and hitting below the belt are also forbidden. The usual length of the rounds in matches is three minutes, with one minute of rest at the close of each round. If either boxer is knocked down by his opponent, he must get to his feet within the count of ten or a *knockout* is declared and he loses the bout. Hitting an opponent when he is down is prohibited.

To make contests fair, boxers are classified according to their weights. The upper weight limit for each class among professional fighters is as follows: fly-weight, 112 pounds; bantamweight, 118; feather-weight, 126; lightweight, 135; welterweight, 147; middleweight, 160; light heavyweight, 175; heavyweight, over 175. These regulations are a part of what are known as the Marquis of Queensberry rules, which the eighth Marquis of Queensberry, an English patron of boxing, helped draw up about 1866. They have done much to maintain the fairness of the sport.

Boxing Terms Explained

The boxing "ring" is really a square—hence the term "squared circle," which is commonly used in accounts of boxing matches. The platform is padded and covered with canvas. The ring, which is from 16 to 20 feet square, is formed of posts and ropes set not less than two feet in from the edge of the platform.

The science of boxing consists of both offense and defense. A good offense can be developed around one or more of the four recognized classes of punches. One of them, the *jab*, is a straight, light punch delivered by straightening out the bent arm. Since the orthodox stance is with the left foot forward and the left arm slightly extended, the *left jab* is most frequent. Although not a knockout blow, the jab is a

point getter. Another straight punch is the *right cross*, which is usually a hard punch with the right delivered immediately after a left jab. The cross may cause a knockout if landed in a vital spot. The most scientific boxers—Tunney was one—use the left jab and right cross effectively. Jack Dempsey, on the other hand, relied almost entirely on the looping, swinging *hook*. In the hook, the fist is thrown in an arc so as to slip under or around the opponent's guard. The *uppercut* is a swinging short blow directed upward, usually toward the jaw.

The defense also is built around four recognized maneuvers. *Blocking* is similar to parrying with swords, except that the glove, forearm, elbow, or shoulder is used in boxing. *Slipping*, which depends on fast footwork, consists of stepping aside and making the opponent miss. *Ducking* is bobbing down so that the opponent's punch goes over the head. *Holding*, when done legally, results in "tying up" the opponent's efforts.

There are other maneuvers both on offense and defense, such as *feinting* with the left preliminary to delivering with the right, or *countering* at the exact moment when the opponent "leads off." But these tricks of the sport come only with long practise.

At the end of each round of a boxing match the better boxer receives 20 points and his opponent proportionately less. Matches may be decided on points if neither contestant is knocked out or disqualified by a foul or voluntarily retires because of injury.

The History of Boxing

There is no doubt that boxing is of great antiquity, for it is mentioned by Homer and it formed a recognized part of the Olympic games and Roman contests. In ancient boxing the fists were bare or even reinforced with a *cestus* of metal and rawhide straps. The use of the padded glove dates from about 1760, but for a hundred years longer boxing or prize fighting continued to be a brutal sport practised by rough and uncouth men who knew no other method of settling disputes.

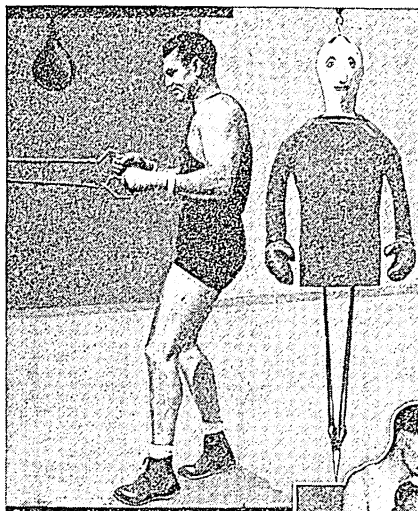
During that time there sprang up both in England and in America self-proclaimed boxing champions. In 1860, John C. Heenan, the American champion, met Tom Sayers, the English champion, near London before a notable audience including the Prince Consort and Lord Palmerston. Although the English champion was outweighed by 50 pounds he fought the American on even terms for nearly two hours, until police stopped the fight. Because of the brutality of the match, boxing was ostracized for more than 20 years afterwards.

Sullivan, the First Great Champion

The sport was brought into better repute about 1881 by John L. Sullivan, the American champion, whose name has become legendary in the annals of the ring. Possessed of unusual strength, some knowledge of the science of boxing, and a colorful and spectacu-

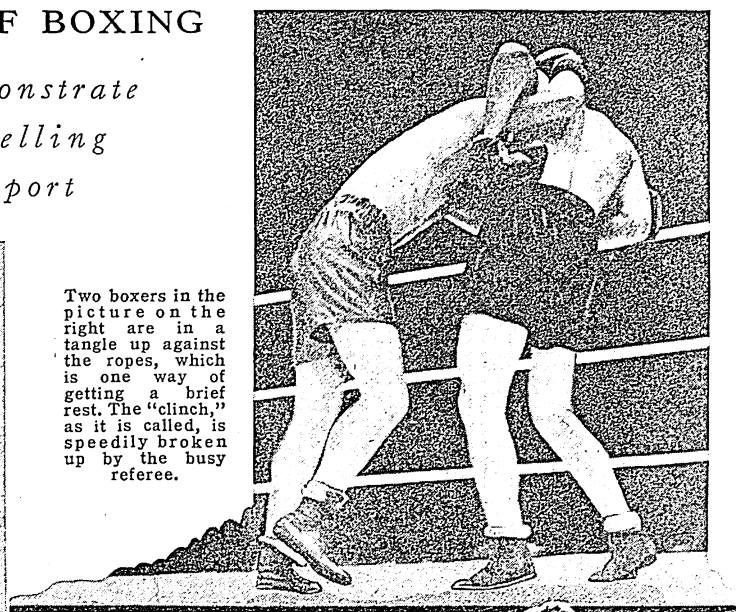
THE MANLY ART OF BOXING

*Experts in Action Demonstrate
Clever Tactics and Telling
Blows of This Fine Sport*

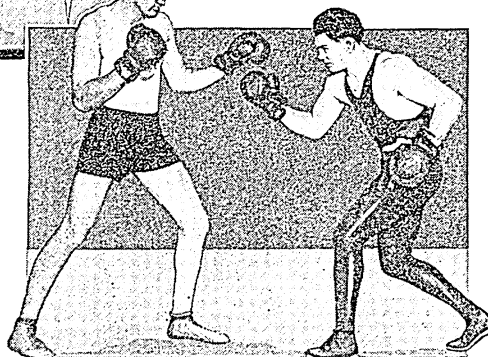


Jack Dempsey, once the heavyweight champion of the world, is seen above in his training quarters, exercising with various devices. He is using the weights to develop his arm and chest muscles. The punching bag gives speed and accuracy; and the boxing dummy serves to develop dodging skill.

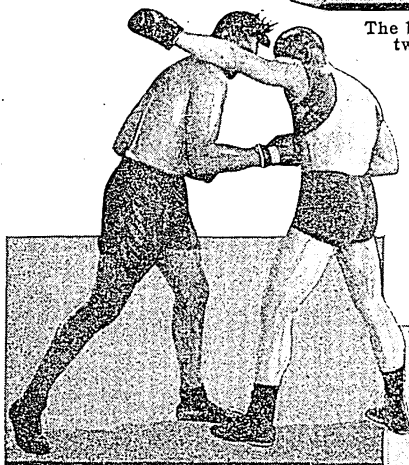
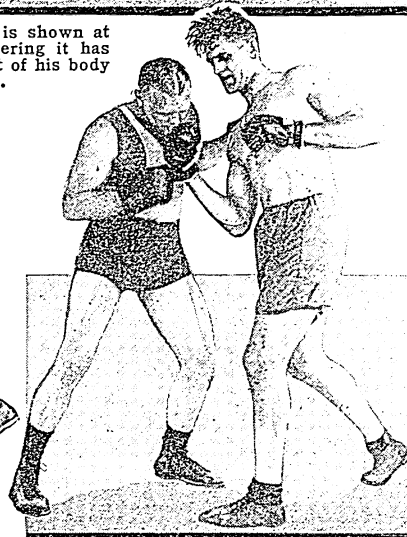
Two boxers in the picture on the right are in a tangle up against the ropes, which is one way of getting a brief rest. The "clinch," as it is called, is speedily broken up by the busy referee.



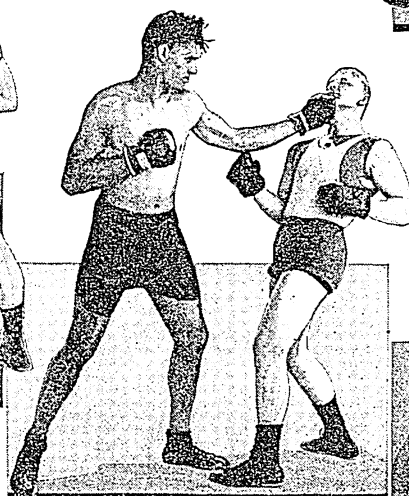
An "uppercut" to the jaw is shown at the right. The man delivering it has stepped in to get the weight of his body behind the blow.



The boxing pose is demonstrated by the two alert athletes pictured above.

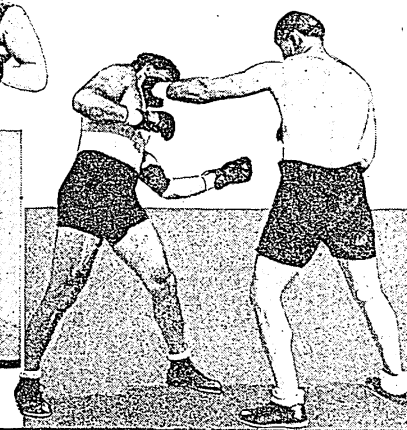


An artful bit of side-stepping by the man at the left above enables him to drive a right to the body while his rival's long left lead glances harmlessly over his shoulder.



His long reach helps the chap on the attack tilt back his foe's head with a snappy left swing.

A neat bit of dodging by the man at the left below diverts much of the force of a straight left to the head.



lar personality, he soon aroused the enthusiasm and interest of American spectators. In 1882, he won a sensational victory over Paddy Ryan and established himself as champion. From that time forward, although he fought one of his greatest fights with bare knuckles in 1889, Sullivan exerted his influence in behalf of better sportsmanship and the Marquis of Queensberry rules, and against the rough tactics which had characterized the sport before.

How Corbett Conquered Sullivan

The first scientific boxer was Sullivan's conqueror, James J. Corbett. In New Orleans in 1892, he ended Sullivan's long reign as champion by a magnificent display of ring craftsmanship. "Gentleman Jim," as his followers called him, knew from the outset that he could not match Sullivan's terrific strength and power. He therefore studied carefully his opponent's weaknesses and methodically perfected the skill necessary to take advantage of those weaknesses. Very few boxers have ever equaled Corbett's speed, footwork, and timing of punches. With consummate skill he dodged and side-stepped Sullivan's ferocious onslaughts until his opponent lost his balance, and then in the 21st round knocked him out. Sullivan himself is supposed to have said later that if only Corbett had stood still for a second he could have finished him.

Fitzsimmons and Jeffries

Five years later, however, came Corbett's fall. His conqueror was the Australian, Bob Fitzsimmons, who weighed scarcely more than a middleweight of today, but had a punch like the kick of a mule. Bob Fitzsimmons met Corbett in Carson City, Nev., and knocked him out with his famous "solar plexus" punch in the 14th round. But Fitzsimmons' reign was comparatively short-lived. A new miracle of strength and power appeared, in the person of James J. Jeffries. He won the title from Fitzsimmons at Coney Island in 11 rounds, June 9, 1899.

Jeffries' reign was a long one, for he defeated challenger after challenger. His punches were delivered with such tremendous power that it was said few boxers ever amounted to anything after they had been hit by Jeffries. After 1903 Jim Jeffries could find no challenger and in 1905 went into retirement for five years. In the meantime the championship was held by two second-rate fighters. The latter of these was knocked out by Jack Johnson, one of the greatest boxers of all time.

The Rise and Fall of Jack Johnson

In 1910, Jim Jeffries yielded to the urging of his friends and came out of retirement to defend his title against the advances of the great Negro fighter. Although it is true that Jeffries' long rest had slowed him down considerably, no credit can or should be taken from Johnson's magnificent battle. The two met in Reno, Nev., July 4, 1910, and Johnson indisputably established his claim to the championship by knocking out Jeffries in 15 rounds. In the opinion of many experts no more versatile boxer than Johnson has ever

ruled as champion. For five years he met and conquered everyone who challenged him, until the sporting world despaired of his ever being dethroned. Each year saw a new "white hope" arise to face the great Negro fighter, only to be disposed of easily.

Finally in 1915 a "white giant," tall and powerful, came out of the West to confront Jack Johnson. His name was Jess Willard. His height was 6 feet 7 inches, and his weight, at the heaviest, 265 pounds. He was a cowboy who, at the suggestion of friends, had taken up boxing as a profession. He overpowered one boxer after another until none remained but the champion. Because of legal difficulties in the United States, a championship match was finally arranged in Havana. There Johnson met his Waterloo. All his skill and science could not save him. Willard had too long a reach, too powerful a body, too great an advantage in height, weight, and youth. In the 26th round he knocked Johnson out and became champion.

Jess Willard Reigns over the Boxing World

Never was a champion more idolized. Jess Willard returned to the United States a hero. Everywhere he was paraded and fêted, and the tall figure of the titleholder became a symbol of manliness. In the next four years few men arose to challenge his supremacy, and those few he disposed of easily. None could match him in physical advantages, and again it appeared that the champion was invulnerable.

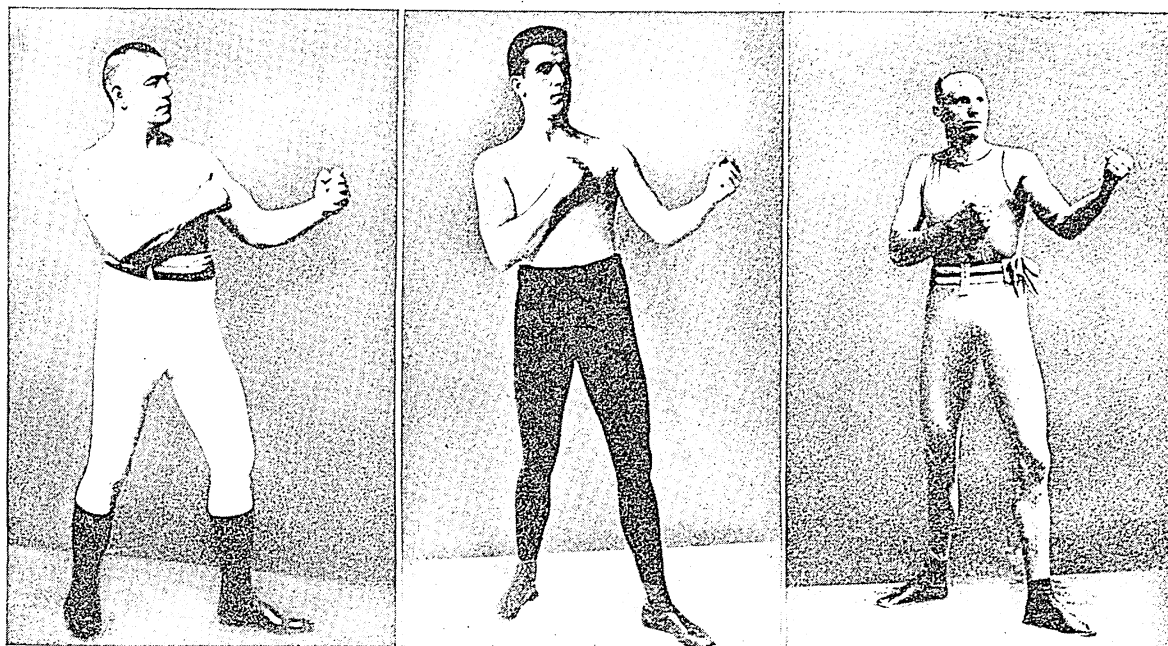
In 1919 the Marquis of Queensberry rules were modified to place even more emphasis on good sportsmanship and skill. Boxing was rapidly becoming one of the most popular sports and people were crowding to attend matches. In that year, Tex Rickard became promoter for Madison Square Garden in New York, and under his direction boxing reached its greatest popularity. The first thing Tex Rickard undertook to do was to find an opponent with courage to face Jess Willard's powerful punches. That man appeared in the person of Jack Dempsey, who had succeeded in knocking out a score or more of boxers throughout the country. For him Tex Rickard arranged a championship match to be held July 4 in Toledo, Ohio.

The Willard-Dempsey Fight

That Independence Day of 1919 is a memorable one in the annals of sport. No one conceded Dempsey much of a chance. He had to give the champion an advantage of some 80 pounds in weight and about 7 inches in height, to say nothing of superiority in reach and girth. Even the optimists among the challenger's friends lost hope the moment the two men entered the ring. Dempsey came in first and looked the picture of health. His long and careful period of training showed in his fine condition. But the champion, though he did not appear as finely fit, certainly looked unconquerable as he towered over Dempsey like a giant over a pigmy.

The bell rang. Both men came out of their corners. Everyone expected to see the big man put the little man down with one powerful blow. The next few

THREE OF THE MOST FAMOUS HEAVYWEIGHT CHAMPIONS



At the left is John L. Sullivan in 1882, after he won the championship from Paddy Ryan. In his later years he wore a heavy moustache. Next, is James J. Corbett, noted for his skill and speed, who defeated Sullivan in 1892. At the right is Bob Fitzsimmons, long-armed and with a reputation for unequaled punching power, who knocked out Corbett with a body blow in 1897.

moments brought amazement. With unbelievable agility Dempsey slipped under Willard's guard and with lightning speed drove a series of terrific blows to the body. With surprise written all over his face, Willard tried to retaliate, but Dempsey, weaving and swaying, blocking and side-stepping, again slipped through the champion's guard and swiftly landed some telling punches to the body. Willard tried to defend himself, but without success. He was facing a younger and faster man as well as a superior boxer.

There before 20,000 frantic spectators an impossible scene began to develop. The little man, with speed the eye could not follow and with power that left red blotches on the champion's body, literally cut the giant down. Like a tall poplar, the champion swayed and toppled to the floor, while spectators pinched one another to prove they were awake in the presence of the unexpected. Seven times in the space of three minutes Willard was knocked to the floor, but like a real champion he arose each time before the fatal count of ten. At the end of the third round, battered and bleeding, he was helped to his corner and could not come back for a fourth round.

Dempsey Holds the Title

Jack Dempsey made boxing history. He was alternately admired and hated, but he was always a box-office attraction. Two years after he won the title, he fought the European champion, Georges Carpentier, before a crowd which paid over a million dollars for admission. The fight lasted only four rounds and less than 12 minutes, but everyone left feeling that he had been well repaid. In that short time the spec-

tators saw Dempsey take his opponent's hardest punches and come back to win the fight in the fourth round by a sensational knockout.

Just two years later, American fans saw another international fight for which they paid even more although it was of shorter duration. In the first round of furious fighting, the crowd saw their champion knocked out of the ring and into the laps of newspapermen, apparently hopelessly beaten. The challenger in this instance was a powerful man from Argentina—Luis Angelo Firpo, "the Wild Bull of the Pampas"—who had a reputation for knocking his victims into unconsciousness. But again Dempsey proved himself the champion. In the second round after 57 seconds of fighting he knocked Firpo out completely.

Dempsey was an active champion. He averaged one championship match a year and met all comers. His crouching, weaving, swaying style and the terrific power of his left hook became famous. Dempsey was not a great defensive boxer because he believed a good offense was the best defense. He usually ended his bouts early and abruptly with a terrific onslaught of left hooks.

Tunney's Science Defeats Dempsey

It was inevitable that Dempsey, like other champions, would one day lose. That day came in September 1926 when he met Gene Tunney, one of the greatest boxers of all time, and the only undefeated heavyweight champion of modern times. Tunney's theory was exactly the opposite of Dempsey's. A master of defense tactics, cool, scientific, fast, and per-

fectly trained, Tunney completely outmaneuvered his opponent and won the coveted championship by gaining a ten-round decision. Unconvinced, Dempsey sought and obtained a return match in Chicago the following year. He succeeded in knocking Tunney down in the seventh round for a count of 9 (which many thought should have been 14); but because Dempsey stood over the fallen man instead of moving into a neutral corner, as provided by the rules, the referee refused to declare a knockout. Tunney then rose, and by superior skill in the remainder of the 10 rounds, managed to gain the decision.

In 1928, Tunney retired from the ring, undisputed champion of the world. Although there had been more sensational titleholders, no other boxer, in the opinion of many critics, has ever equaled Tunney in boxing skill, ring generalship, and clean sportsmanship. His retirement threw the heavyweight championship into such confusion that boxing was long in recovering.

In an effort to bring order out of the chaos of claims, the New York Boxing Commission in 1930 matched two of the leading contenders, Jack Sharkey of Boston and Max Schmeling of Germany. The latter won in the fourth round on a foul and was made champion in spite of considerable protest. A return match was held in 1932 and this time Sharkey won. A quick succession of champions followed. Sharkey lost his championship in 1933 upon his first defense, to Primo Carnera of Italy, in the sixth round. Carnera in turn lost the title a year later to Max Baer of California in a battle of 11 rounds. In 1935 Baer lost to James J. Braddock by a 15-round decision.

The Rise of Joe Louis

The apparent low caliber of professional champions had resulted in diminishing popular interest in boxing, but a new stimulus came from the ranks of the amateurs. Out of the *Chicago Tribune* and *New York Daily News* Golden Gloves tournament, which each year offers amateurs throughout the country an opportunity to compete for real prizes, came a young Negro boxer named Joe Louis. In his first year of professional fighting he defeated more than a score of the best heavyweights in the country, including three former champions. The ease with which he won these victories, and his amazing combination of speed and power, brought fans flocking back to boxing matches.

His rise, however, was momentarily stopped by Max Schmeling, who scored a surprise victory in the 12th round over Louis in New York in 1936. Within three months, Louis came back with a knockout over Jack Sharkey in the third round and thus began another series of impressive victories. Then—despite Schmeling's earlier victory over him and numerous protests from fight fans—Louis was given the first chance at challenging James J. Braddock's title. The championship match was held in Chicago on June 22, 1937.

Though handicapped by a layoff of two years, the courageous Braddock carried the fight to the challenger, and in the opening round floored him. But youth, speed, and stamina were on the side of Louis.

In the eighth round Braddock was knocked out by a hard right to the jaw, and for the second time in ring history a Negro became heavyweight champion.

In 1938 in New York City, Louis proved that he deserved the title. He battered Schmeling, his former conqueror, into such helplessness that the referee stopped the fight in the first round.

Collegiate Boxing

In colleges, boxing has been popular chiefly as an intramural sport. It appeared on the intramural program of Harvard University as early as 1880. Since the World War of 1914–1918, however, interest has been awakened in intercollegiate matches. The first of these was held in 1919 between the University of Pennsylvania and Pennsylvania State College.

The Heavyweight Champions

Titleholders and, in parentheses, men defeated for title: J. L. Sullivan (Paddy Ryan, 1882); J. J. Corbett (Sullivan, 1892); Robert Fitzsimmons (Corbett, 1897); J. J. Jeffries (Fitzsimmons, 1899); Tommy Burns (Marvin Hart, 1906); Jack Johnson (Burns, 1908); Jess Willard (Johnson, 1915); Jack Dempsey (Willard, 1919); Gene Tunney (Dempsey, 1926); Max Schmeling (Jack Sharkey, 1930); Sharkey (Schmeling, 1932); Primo Carnera (Sharkey, 1933); Max Baer (Carnera, 1934); J. J. Braddock (Baer, 1935); Joe Louis (Braddock, 1937).

BOYCOTT. In the year 1880 there was much commotion in County Mayo, in the west of Ireland. The whole of the island was then in the midst of the great land struggle, with its demand for the "three F's"—*fixity of tenure*, or the right of the tenant to keep his land as long as he paid the rent for it; *free sale*, or the right to sell his interest in the land to whomever he wished; and *fair rent*, which would prevent the landlord from raising the rent unjustly. To enforce these demands the Irish Land League was formed. Its members agreed that any landlord or agent who refused to grant their demands should be "isolated from his kind as if he had been a leper of old."

Capt. Charles C. Boycott, the agent in County Mayo for the estates of an Irish lord, was the first victim of this agreement. From his name we get the now common word "boycott," meaning to combine against a man or group of men by refusing to deal with them, to buy from or sell to them, or have social relations with them. In the last sense it is about the same as "sending a person to Coventry."

Because Captain Boycott would not come to terms with his tenants, the population for miles around would have nothing to do with him or his family. His servants were coaxed or driven away, his food supplies were interfered with, and his fences were torn down. He finally had to leave the country.

The boycott is now frequently used by labor unions, whose members refuse to buy goods made by non-union workers. English courts have recognized the legality of the boycott, but United States courts have taken a strong stand in opposition to it, and a number of states have passed laws prohibiting its use. Whole peoples sometimes use the boycott against other national groups, as when Chinese merchants refused to buy Japanese goods because of the friction between the two countries. Consumers also have employed this weapon as a protest against prices or labor conditions.

What a BOY SCOUT NEEDS to KNOW

IT IS true that our teachers are guiding our children in the first steps of democracy, but I know of no agency that can be more powerful in support of this purpose than the Scout movement. If we look over the Republic today we find many failures in citizenship; we find many betrayals of those who have been selected to leadership. I cannot conceive that these failures would take place if every citizen who went to the polls was a good "Scout" and every official who was elected had been a real Boy Scout.—Herbert Hoover.

BOY SCOUTS OF AMERICA. Scouting gives a boy something to do, something he likes to do, something worth doing. It makes the boy want to learn. It organizes the gang spirit into group loyalty.

Scouting helps solve the present-day problem of leisure time. It offsets the defects of the artificial life of the great cities by teaching the boy to know and love the beauties of nature. If it be true that a well-rounded life includes outside interests and hobbies, there is no firmer foundation on which to build such a life than on the valuable and fascinating activities of a Scout.

A merchant who had been born on a pioneer farm once pointed out how easy it formerly was for a boy to live close to nature:

"It was worth while being a boy fifty years ago. I could ride and shoot and swim and fish and go on snowshoes like an Indian; find my way in the woods by blazes on the trees and by the stars; catch and cook my own supper, and make a good shelter and bed. I knew all the wild plants and birds and animals. A boy had to rely on himself in those days and be of use to others, and it made a man of him."

Scouting recaptures this romance of living close to nature and makes it the precious possession of the city-bred boy, who may be too much taken up with the artificial amusements of the Machine Age.

What the Boy Scout Learns

The Scout gets to know and love the great outdoors intelligently. He camps and hikes and swims; studies birds and trees and stars; knows how to care for himself in the open, how to build fires and make camp cookery, how to set up tents and make himself comfortable and safe even under open skies if necessary, how to tie knots and how to use an ax and knife. *Be Prepared* is the Scout motto, and preparedness of this kind is good training for every man.

Incidentally a Scout also learns self-reliance, resourcefulness, courage, fair play, obedience, loyalty, and other so-called "old-fashioned" virtues, which are as valuable in the 20th century as they ever were in the past. In fact, the real purpose of Scouting is to help build character for good citizenship. But from the boys' point of view, Scouting is a game and the Scout program is fun. Hence the Scout learns because he is naturally interested. That is the secret of the Scout movement's success: it appeals so power-



The bugler holds an important position in the troop. His call means fun and action—and is eagerly answered.

fully to the boy that he follows it voluntarily. Thus it has the power to draw him into wide and fruitful fields of worth-while recreation and endeavor.

Good Citizenship and Service Its Aims

Good citizenship making is the end and aim of Scouting. The movement believes that by making better American boys, fit every way—mentally, morally, and physically—it can best serve the nation and provide a vital man power of brains, efficiency, and high moral standard.

The idea of *service* is fundamental in the Scout movement. The daily good turn which every Scout promises to perform is a small thing in itself, but it represents a big thing—perhaps the biggest thing, the most redeeming force in the world—the willingness to serve others unselfishly, simply, looking for no reward; a service done for the love of service itself. The good turn magnified means community service. And everyone familiar with Scouting knows what a record along this line Boy Scouts have, how they serve as traffic guides, police aides, messengers, distributors of "literature," and collectors of newspapers and rubbish; how they have led in innumerable "clean-up," "swat-the-fly," "walk-right," and "city beautiful" campaigns; how they have cooperated with fire commissioners, park commissioners, fish and game commissioners, and forest wardens, active and enthusiastic in every undertaking which contributes to the betterment of the community and constitutes real service.

The service record of Boy Scouts in the first World War was little short of phenomenal. In the Liberty Loan campaigns they sold bonds to the amount

of millions, aided the Red Cross and other organizations, and did other valuable work. "Be Prepared" is the Scout motto, and because the Scout is prepared, hundreds of lives have been saved. He must pass rigid tests in first aid, and his training gives him such self-reliance that in accident or disaster the Scout is a great help to doctors or authorities. Boy Scouts have taken full charge after fires, tornadoes, and all manner of accidents.

So widely is the value of their training recognized that many scholarships are offered to Scouts, and they have won many scholastic and other competitions open to all boys. Many schools and colleges award scholarships on the basis of Scouts' scholarship and high character standing. Records show that Scouts are leaders in all activities in schools and colleges. Scouts have taken part in scientific, hunting, exploring, and other expeditions for which trained boys were needed. A Boy Scout made the trip to the South Pole with Admiral Byrd, and three Scouts went to Africa with the Martin Johnson expedition. Boy Scouts are thought of at once when a youth of character, strength, and willingness is required for any task.

Every boy who becomes a member of the Boy Scouts of America takes an oath and subscribes to the Scout Law. He also takes the oath of allegiance to the flag. Before he becomes a scout the boy must promise:

"On my honor I will do my best—

To do my duty to God and my country, and to obey the scout law;

To help other people at all times;

To keep myself physically strong, mentally awake, and morally straight."

A scout is required to know the Scout oath and law and to subscribe to both. But his obligation does not end here. He is expected not only not to forget his oath and law, but to live up to them in letter and spirit from first to last.

A boy who wants to become a scout should apply

to the local scouting authorities if scouting is established in his community. Through these local leaders he will be given an opportunity to join a troop already established, or machinery will be set in motion for the organization of a new troop, if the boy knows of others who also would like to become scouts.

Scouting is supervised by local councils in over 550 cities and towns, and other such councils are being

constantly established.

Any man or boy interested in starting scouting in a community should write at once to the National Council, Two Park Avenue, New York City, and secure the necessary information as to procedure and copies of the many available pieces of scout literature. The official 'Scout Handbook for Boys' is obtainable either from local booksellers or national headquarters.

It is necessary to have at least eight boys, or one patrol, to organize a Boy Scout troop. A full troop consists of 32 boys—that is, four patrols of eight boys each. These troops must be under the leadership and direction of a scout master, who must be at least 21 years of age and must receive his commission from the national council at the recommendation of the church, or institution, or group of adult male

American citizens, who make themselves responsible for the troop in accordance with the requirements of the national council. Each troop has at least one assistant scout master, who must be 18 years old or over, and must be commissioned by the national council.

Every troop of Boy Scouts is under the supervision of a troop committee, consisting of three or more adult American citizens, representing the church or other institution or group of men, who select the scout master and make themselves responsible for the execution of the scout program of the troop, and for the provision of suitable facilities for the same.

In a community under a local council, the latter unit has general supervision of scout activities in the

THE SCOUT LAW

1. *A scout is trustworthy.* A scout's honor is to be trusted. If he were to violate his honor by telling a lie, or by cheating, or by not doing exactly a given task, when trusted on his honor, he may be directed to hand over his scout badge.

2. *A scout is loyal.* He is loyal to all to whom loyalty is due: his scout leader, his home and parents and country.

3. *A scout is helpful.* He must be prepared at any time to save life, help injured persons, and share the home duties. He must do at least one good turn to somebody every day.

4. *A scout is friendly.* He is a friend to all and a brother to every other scout.

5. *A scout is courteous.* He is polite to all, especially to women, children, old people, and the weak and helpless. He must not take pay for being helpful or courteous.

6. *A scout is kind.* He is a friend to animals. He will not kill nor hurt any living creature needlessly, but will strive to save and protect all harmless life.

7. *A scout is obedient.* He obeys his parents, scout master, patrol leader, and all other duly constituted authorities.

8. *A scout is cheerful.* He smiles whenever he can. His obedience to orders is prompt and cheery. He never shirks nor grumbles at hardships.

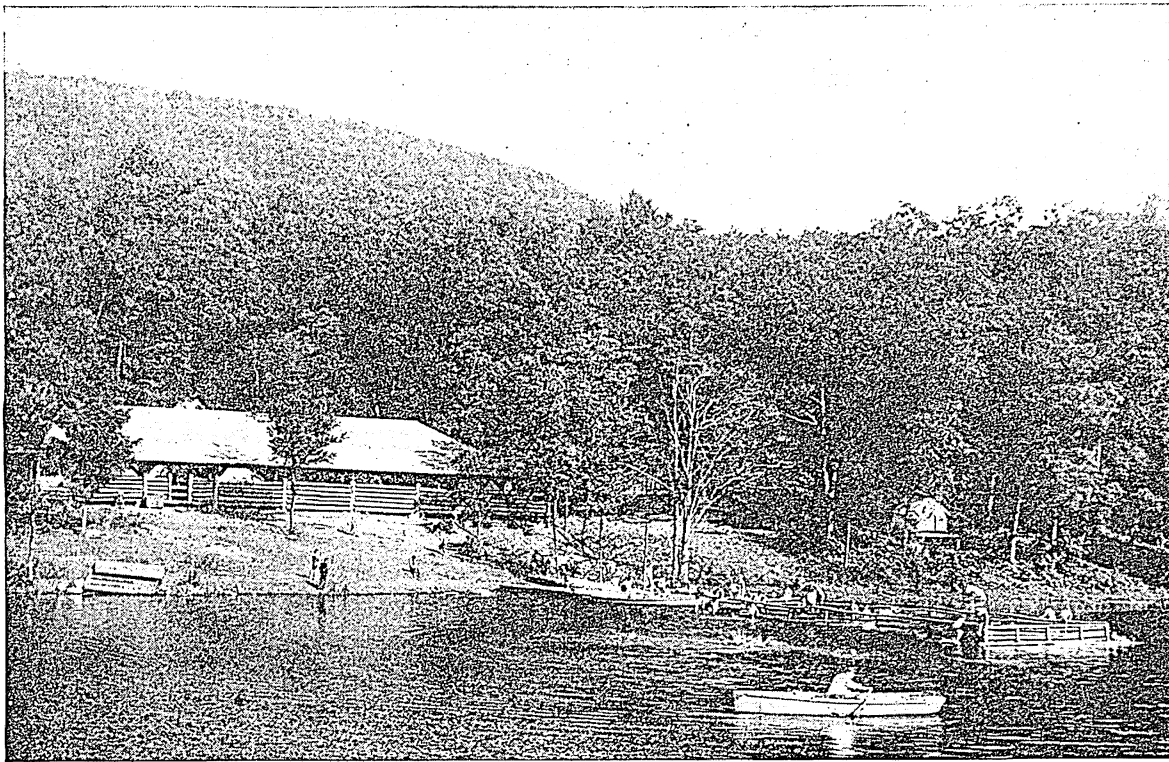
9. *A scout is thrifty.* He does not wantonly destroy property. He works faithfully, wastes nothing, and makes the best use of his opportunities. He saves his money so that he may pay his own way, be generous to those in need, and helpful to worthy objects. He may work for pay, but must not receive tips for courtesies or good turns.

10. *A scout is brave.* He has the courage to face danger in spite of fear, and has to stand up for the right against the coaxings of friends or the jeers or threats of enemies, and defeat does not down him.

11. *A scout is clean.* He keeps clean in body and thought, stands for clean speech, clean sport, clean habits, and travels with a clean crowd.

12. *A scout is reverent.* He is reverent toward God. He is faithful in his religious duties and respects the convictions of others in matters of custom and religion.

SUMMER DELIGHTS OF WOODS AND WATERS



Just to look at a place like this—and much more, if one were actually there—would lead one to suppose that the Boy Scouts were mainly organized for the purpose of getting the keenest possible enjoyment out of life! And this is more or less true; for it is not only in the sport and the outdoor life of the summer camp that the joy of being a scout consists, but the pleasure of service; it is even better to give than to receive.

community. The troop committee deals directly with its own troop, and is entitled to a representative on the local council.

To enter scouting a boy must be at least 12 years of age. There is no upward age limit. Older boys often become assistant scout masters. After five years of service the first class scout may apply for membership in the Veteran Scout Association.

There are three classes of scouts, known respectively as tenderfoot, second, and first class scouts. The requirements for the various ranks are as follows:

Tenderfoot—

1. Know the Scout oath and law, motto, sign, salute, and significance of the badge and uniform.
2. Know the composition and history of the flag of the United States of America and the customary forms of respect due it.
3. Tie the square knot and any eight of the following knots: sheet bend, bowline, fisherman's, sheepshank, slip, clove hitch, timber hitch, two half hitches, carrick bend, miller's knot, rope halter, pipe hitch, stevedore, barrel hitch, girth hitch, binder twine bend, lariat loop, hitching tie.

Second Class—

1. At least one month's service as a tenderfoot.
2. Show what to do for: cut on finger and forearm; knee deeply scraped and bleeding; black eye; bleeding nose; blister on heel; fainting; blow in pit of stomach; apparent death from inhaling gas, drowning, or electric shock; and severe scald. Tell what should be done for: pimple on face; ear-ache; splinter under finger nail; cinder in eye; sunburn;

shock. Tell danger of taking a physic for pain in region of stomach without consulting physician.

3. Elementary signaling: know the alphabet of the semaphore code, of the general service code (international Morse), or the elementary signs of the Indian sign language code.

4. Track half a mile in 25 minutes; or, if in town, describe satisfactorily the contents of one store window out of four observed for one minute each.

5. Go a mile in 12 minutes at scout's pace—about 50 steps running and 50 walking alternately, or lay out, measure by the stride method, and stake a four-acre tract of land.

6. Use properly knife or hatchet.

7. Prove ability to build a fire in the open, using not more than two matches, care for, and put it out.

8. Cook a quarter of a pound of meat and two potatoes in the open without any cooking utensils.

9. Earn and deposit at least one dollar in a public bank (premiums paid on life insurance are accepted, if earned); or earn, own, and raise some farm animal.

10. Know the 16 principal points of the compass.

11. Demonstrate his practise of at least five rules of safety at home, or work, or school, or on the street, or road, or farm.

12. Furnish satisfactory evidence that he has put into practise in his daily life the principles of the Scout oath and law.

First Class—

1. At least two months' service as a second class scout.
2. Swim 50 yards.
3. Earn and deposit at least two dollars in a public bank (premiums paid on life insurance accepted, if earned); or plant, raise, and market a farm crop.
4. Send and receive a message by semaphore code, in-

BRINGING WATER UP FROM THE SPRING



Here is another scene in the woods, in a permanent Boy Scout camp, showing boys bringing water from the spring. Could anything be more picturesque, with the graceful trees in the morning light, the shrubbery and the vines? There is evidently quite a slope down to the spring and crude steps have been made leading up to scout headquarters.

cluding conventional signs, 30 letters per minute; or by the general service code (international Morse), including conventional signs, 16 letters per minute, or by the Indian sign language code, 30 signs per minute.

5. Make a round trip alone (or with another scout) to a point at least seven miles away (14 miles in all), going on foot or rowing a boat, and write a satisfactory account of the trip and things observed.

6. Review second class first aid requirements. Describe methods of panic prevention, what to do in case of fire, ice, electric, and gas accidents; what to do in case of a mad dog bite, or snake bite. Demonstrate the treatment, including dressing where necessary, for a fracture, poisoning, apoplexy, heat exhaustion, sunstroke, frost bite, and freezing; also demonstrate the treatment for sunburn, ivy poisoning, game stings, nose-bleed, earache, grit or cinder in the eye, stomach-ache; demonstrate transportation of the injured; demonstrate the triangular bandage on the head, eye, jaw, arm (sling), chest, fractured rib, hand, hip, knee, ankle, and foot. (Roller bandage may be substituted on arm and ankle.) Demonstrate how to make and apply a tourniquet.

7. Prepare and cook satisfactorily in the open, using camp cooking utensils, one of the following dishes as may be directed: eggs and bacon, hunter's stew, fish, fowl, game, pancakes, corn bread, biscuit, or a "twist" baked on a stick, oatmeal or other cooked cereal, and give an exact statement of the cost of the materials used. Explain to another boy the methods followed.

8. Read a map correctly, and draw, from field notes made on the spot, an intelligible rough sketch map, indicating by their proper marks important buildings, roads, trolley lines, main landmarks, principal elevations, etc. Point out a compass direction without the help of a compass.

9. Use properly an ax for felling or trimming light timber; or produce an article of carpentry, cabinet-making, or metal work made by himself; or demonstrate repair of a decaying or damaged tree. Explain the method followed.

10. Judge distance, size, number, height, and weight within 25 per cent.

11. Describe fully from observation ten species of trees or plants, including poison ivy, by their bark, leaves, flowers, fruit, and scent; or six species of wild birds, by their plumage, notes, tracks, and habits; or six species of native wild animals, by their form, color, call, tracks, and habits; find the North Star, and name and describe at least three constellations of stars.

12. Furnish satisfactory evidence that he has put into practise in his daily life the principles of the Scout oath and law.

A second class scout may earn five merit badges from a selected list of 40. A first class scout may qualify in any or all of the merit badge subjects, in addition to the five he may have earned as a second class scout. These subjects include a wide variety of activities, such as bee-keeping, photography, path-finding, etc. The requirements are given in the official Boy Scout Handbook.

There is an appropriate badge for each rank in scouting.

To become a star scout the first class scout of three months' service may qualify for any five merit badges.

The life scout badge is awarded to the star scout of three months' service who has qualified for the merit badges in

first aid, physical development or athletics, personal health, public health, life saving, pioneering, or safety.

The eagle scout award is made to the first class scout of one year of service who shall have qualified for 21 merit badges, including first aid, life saving, personal health, public health, cooking, camping, civics, bird study, path-finding, pioneering, athletics or physical development. The eagle scout may win palms for additional merit badges.

Medals for conspicuous bravery in life saving are conferred by the national court of honor. A medal is also offered for distinguished service to wild life.

Uniform and Equipment

The possession of a uniform is not obligatory, but it is strongly advised. Scouts are expected to keep their uniforms in good condition and to respect them as the symbol of the things for which scouting stands. The official scout uniform is thus described:

Hat—khaki colored felt with low crown, wide brim. *Shirt*—khaki cotton or wool; loose roll collar with neckband, two Stanley patch breast pockets with flap to button down; lettering "Boy Scouts of America" in red silk over right pocket; official buttons with scout insignia. *Neckerchief*—plain or combination color according to council, district, or troop regulations; square or triangular. *Breeches and Shorts*—khaki cotton or wool; two front, two hip, and one watch pocket. *Coat*—khaki colored cotton or wool; loose roll collar, two Stanley breast pockets, two lower side pockets, one plait in center back extending from yoke to waist, 2 inches wide; lettering "Boy Scouts of America" in red silk over right breast pocket; no belt; buttons with scout insignia.

Other useful articles of equipment are lanyard, knife, ax, canteen, staff for walking, and first-aid kit. Some equipment is owned by the troop as a whole, such as signaling and camping outfits, troop and national flags, and books. The troop committee is responsible for this general troop property.

The troop committee secures a suitable meeting place for the troop. This is more easily arranged when troops are connected with an established institution such as a school or a church. Sometimes headquarters are donated by public-spirited men, and sometimes the boys build a rough shack and make their own furniture.

Every troop has its own colors, which appear in the neckerchief. Each separate patrol has its own "totem" name, such as wolf or badger or eagle, and its own call, representing if possible the patron bird or animal. In this way scouts of the same patrol may communicate with each other when in hiding or at night.

In addition to the scout master and a commissioned assistant, the troop officers are a senior patrol leader; four patrol leaders; a scribe (secretary); and a treasurer. The office of treasurer may be combined with that of scribe. There may also be a bugler, color bearers, librarian, and custodian.

The Broadening Program

Scouting activities are now being extended to provide a continuous program of character development from 9 years of age to 21 and beyond. To meet the desire of the younger boy to be "at least half a scout," as one youngster expressed it, "cubbing" was inaugurated in 1929. Boys 9 to 11 years old may become Cubs by organizing a "Pack" made up of neighborhood "Dens," which correspond to the Scout Troop and Patrols. Cub activities center about the home and neighborhood, and parents work closely with the boys. In England younger boys are enrolled as "Wolf Cubs."

When a boy is 15 years of age, he becomes a Senior Scout and follows an advanced program either as an Explorer Scout or as a Sea Scout. The United States Navy Department coöperates with the Sea Scouts in providing opportunity for training on water. In England the Deep Sea Scouts were organized among boys who follow the sea as a vocation. Explorer scouting started in the mountainous regions of the western United States about 1935 and is growing rapidly. The purpose of this program is to *use*, in wider adventure, the outdoor craft *learned* in Scouting. At 17 the boy becomes eligible to be a "Rover" with a new and fascinating program adapted to his more mature interests.

Boys who live in rural communities too small for Troops may organize a Neighborhood Patrol of two to eight members. Or a boy may become a Lone Scout and, under the direction of national headquarters, follow much the same program and earn the same awards as the boys in troops. Lone Scouts often form Lone Scout Tribes. The Lone Scouts were organized in 1909 by William D. Boyce and merged with the Boy Scouts of America in 1924. Scouting makes special provisions for boys that suffer from physical handicaps—the deaf, the blind, and the crippled. They are known as Achievement Scouts, and pursue a program adjusted to their handicaps.

History of the Movement

The Boy Scout movement had its inspiration in the Boer War of 1899–1902. Robert S. S. Baden-Powell (later Baron Baden-Powell), who was then a colonel in the British army, had the task of training raw recruits in South Africa. He was impressed with their weak character and their inability to take care of themselves. On his return to England in 1903 he began to adapt his experiences with soldiers to the training of boys, and in 1907 opened his first experimental camp at Brownsea Island. The following year appeared his famous book 'Scouting for Boys', on which the movement has been based.

Lord Baden-Powell called himself only one of several "uncles" of the Scouts. Many of his ideas he borrowed from the older American societies—the "Sons of Daniel Boone" organized by Daniel Carter Beard, and Ernest Thompson Seton's "Tribe of Woodcraft Indians." William D. Boyce, a Chicago publisher, was instrumental in bringing the movement to the United States, and on Feb. 8, 1910, the Boy Scouts of America was incorporated in Washington. Congress authorized the organization in June 1916. The Boy Scout movement flourishes in many countries, though totalitarian governments prohibit it. The United States membership is about a million and a half.

The movement was planned to meet the need of boys of every party, creed, race, or environment. It recognizes, however, the importance of religious training and promotes coöperation with the churches.

The plan of the organization is to supplement and reinforce in every way the natural agencies of boy training, such as the church, the school, and the home. It is the universal verdict of those associated with these

troops that the institution with which the troop is connected is invariably greatly benefited by having at its command the most popular and most practical as well as the most ideal system of juvenile education yet invented.

That the scout movement is worth promoting and encouraging goes without saying. The nation-wide support given to its annual "anniversary week," and the endorsement and active coöperation of leading men in every profession, show the need and value of the scout idea. The public can scarcely spend its dollars on a better cause than on making Young America clean, fit, "prepared" for the future in every way. Leaders especially are needed to meet the increasing demand of the boys themselves for the privileges and pleasures of scouting. Men are needed to serve as scout masters and assistant scout masters, troop committeemen, and local council members. Any man who is interested either in becoming a scout leader himself or in helping to organize troops should apply at once to local or national scout headquarters.

Useful books are: 'Scout Handbook for Boys', 'Seascout Manual', 'Handbook for Scoutmasters', merit badge pamphlets, and other material published by the Boy Scouts of America; 'Boy Scout and His Law', by Barry Chalmers; 'High School Boy and His Problems', by T. A. Clark; 'First Aid for Boys', by N. B. Cole; 'Boy's Book of Strength', by C. W. Crampton; 'Growing Into Manhood', by R. E. Dickerson; 'Camping and Woodcraft', by Horace Kephart; 'Adolescent Boy', by W. V. Richmond; 'The Right Thing', by W. O. Stevens. For full bibliography on scout work, see the appendix of the publications and handbooks of the Boy Scouts of America.

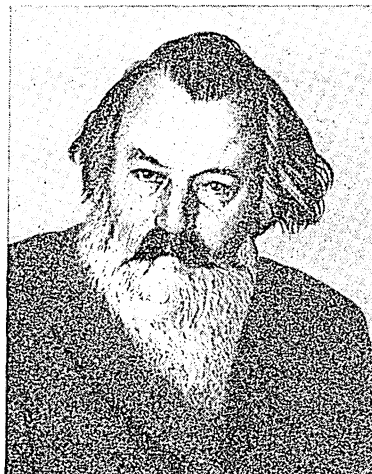
BRAHMA. An Indian deity of the ancient Hindu religion. Brahma is thought of as the creator of the world and the first member of the Hindu Trinity, which includes Vishnu the preserver, and Siva the destroyer and reproducer. In art he is represented with four heads and as many arms. In the Rig-Veda, one of the great religious books of the Hindus, dating from more than 1,000 years before Christ, the name Brahma represents the essence of the universe, from which all created things are evolved and into which they return. The primitive religion of the Hindus is called Brahmanism, from the name of its chief deity, and the term Brahman still denotes a member of the sacred priestly caste among the Hindus. (See Hinduism; India.)

BRAHMS, JOHANNES (1833-1897). In the middle of the 19th century, when the musicians of Europe were arguing whether old forms of music were "worn out" and new forms were needed, one composer, Johannes Brahms, wrote symphonies and other works which seemed to answer the question in favor of each side. Adherents of the classic forms could point out that

he adhered strictly to their rules in musical structure. Innovators could claim that he achieved entirely new effects and hence in reality had broken with older ways. When the debating subsided, most musicians took the position that whether "old" or "new," Brahms' music was superb, and many agreed with Bülow's phrase of "the three B's," grouping Bach, Beethoven, and Brahms as the supreme masters of their forms. (See Music.)

The man who did so much to upset European musical thought was born in Hamburg, Germany, on May 7, 1833. His father played double-bass in an orchestra; his mother kept a little shop to eke out

A GENIUS AS BOY AND MAN



Brahms is often grouped with Bach and Beethoven—the "three B's"—as supreme masters of musical composition.

the family's limited income. At the age of eight young Brahms began his lessons in piano playing. Soon after that, his talent led a celebrated teacher, Marxsen, to teach him without pay. At the age of 11, he made his first attempts at composition. At 15, he gave his first concert in Hamburg, and when 20 years old, he made a concert tour as accompanist to the celebrated violinist, Reményi. At one of the concerts it was found that the piano was a semi-tone below the pitch, whereupon the youthful Brahms transposed a Beethoven sonata at sight, a real feat of musicianship. The violinist Joachim, who was present, was so impressed that he gave Brahms a letter to Robert Schumann. After

receiving Brahms and hearing him play his Sonata in C Major, Schumann published in his music journal an enthusiastic account ('*Neue Bahnen*', or 'New Ways') which drew the attention of all German musicians to the young composer.

But Brahms, instead of seeking advantage from Schumann's glowing tribute, retired into comparative obscurity to mature his ideas. In 1857 he accepted a position at the court of the Prince of Leppi-Detmold. Here he conducted a choral society and gave piano lessons, but had considerable free time for composition. Schumann died in 1856, but Madame Schumann soon began to play his piano compositions in public. This made him widely known.

In the autumn of 1862 he settled in Vienna, where he remained to the end of his life. Early in that period he became conductor of the *Singakademie*, a well-known chorus. By this time, prominent publishers were anxious to bring out his compositions. His mother died in 1865, and Brahms then composed in her memory his famous 'Requiem'.

In 1872 Brahms accepted the post of director of the Concerts of the Society of Friends of Music. In 1875 he resigned this position and thereafter kept himself entirely free for composition. He received a degree from Breslau University and wrote for his

thesis the 'Academic Overture', which is based on students' songs and is full of gaiety and humor.

Brahms cared little for outward show, refusing to go to Cambridge University, which offered him a degree, largely because he did not want to submit himself to the formality he imagined English life required. He lived chiefly within himself, yet his connection with the world around him was wide, intimate, and true. He was a sturdy large-framed man, of placid bearing and serene temper, very self-contained, quite unmindful of popular approval. His humor was at times rather grim, and he was, on occasions, sarcastic. He was, nevertheless, a kindly man and a warm friend to those he liked. Occasionally he would leave for short trips to the Austrian Alps or Italy. He never married. He died in Vienna, April 3, 1897, and is buried in that part of the cemetery where rest also Mozart, Beethoven, Schumann, Schubert, Wolff, Johann Strauss, and Weber.

On first hearing Brahms, one may be inclined to consider the music "jumbled" in spots, and to miss the sonorous harmonies which ring out so clearly in, say, a Beethoven symphony. This is because Brahms did not hesitate to use more themes and more rhythms

at the same time, and to employ more varied instrumental effects, than did his predecessors. But when one learns enough music to understand and follow all the material Brahms is using at the moment, the supposed "jumbling" disappears, and the musical effects are as clear and in as strict conformity with sound musical principles as anything ever written. The comparison between earlier masterpieces and Brahms is the musical counterpart of the difference between a severely simple Greek temple and a richly ornamented Gothic cathedral, radically unlike in appearance, but alike in perfection of design.

There are beautiful songs for you to try over: 'Der Schmied', 'Die Mainacht', 'Sapphische Ode' are among them. In the 'Book of Songs and the Junior High School Song Book' (see Music) will be found part songs, choruses, etc. The simplest of Brahms' piano compositions are to be found among the 'Intermezzi', (Opus 117, 118, and 119). All the symphonies, the 'Academic Overture', the variations on a theme by Haydn, parts of the 'Requiem', the great Piano Quintet in F Minor, the String Quartet in A Minor, and some of the songs are recorded for phonograph. The most complete biography is by Florence May (published by Edward Arnold, 41 Maddox Street, Bond Street, West, London). 'Personal Recollections of Johannes Brahms', by George Henschel (published by Richard G. Badger, Boston) and 'Johannes Brahms' by Richard Specht are valuable.

The EVERLASTING Wonder of YOUR BRAIN

BRAIN. A man can swim, but not to be compared with a fish. He can run, but not nearly fast enough to catch a rabbit. In strength he cannot begin to match the bull, the bear, or the elephant. Yet he is easily the master of all these creatures; and he can do much that no animal can do.

He can fly in machines of his own making, faster than any bird. He can build bridges, fight disease, and create matchless works of art. He can see nebulae a million light years away, and think of eternal life. He can pass on what he has learned to future generations. He does these things with the aid of an organ that weighs three pounds or less—his brain. Let us see how it is made and how it works.

First of all the brain is part of the nervous system which man possesses just as do all but the lowest animals (see Nerves). In the nervous system of backboneed creatures or vertebrates many of the longer communicating nerve fibers are gathered into a central cable, the *spinal cord*, inside the backbone. On top of the cord is a swelling which serves as a sort of "central exchange." This "exchange" is the brain.

The brain is housed in a bony shell, the *cranium* or upper part of the skull. This can resist any ordinary blow. Shocks and jars are minimized by three supporting membranes or

meninges, which suspend the brain and spinal cord in a bath of cerebrospinal fluid. A tough outer one, the *dura mater*, adheres to the skull and the backbone through fat pads. A delicate inner one, the *pia mater*, adheres to the brain and carries blood vessels. The two are held together by the weblike middle membrane, the *arachnoid*.

General Structure of the Brain

The brain itself, as seen from any side except the bottom, looks somewhat like a huge, soft, grayish English walnut. Not only is its surface wrinkled; it is divided into two halves, like a walnut. Together these two wrinkled halves, called *hemispheres*, constitute the *cerebrum* (the Latin word for "brain").

These two portions are linked by various structures which run crosswise through the base of the brain.

From these basal parts a thick stem extends downward and joins the spinal cord. The main body of the stem is called the *medulla oblongata*. Behind the stem, and below the cerebrum, are two wrinkled dwellings about as large as fists. Together they form the *cerebellum* (Latin for "little brain.")

In general, the cerebrum conducts conscious mental activity of the sort which sets man apart from all the animals. It also controls habitual or "learned" actions, such as the sequence of motions we make

FACTS ABOUT THE BRAIN

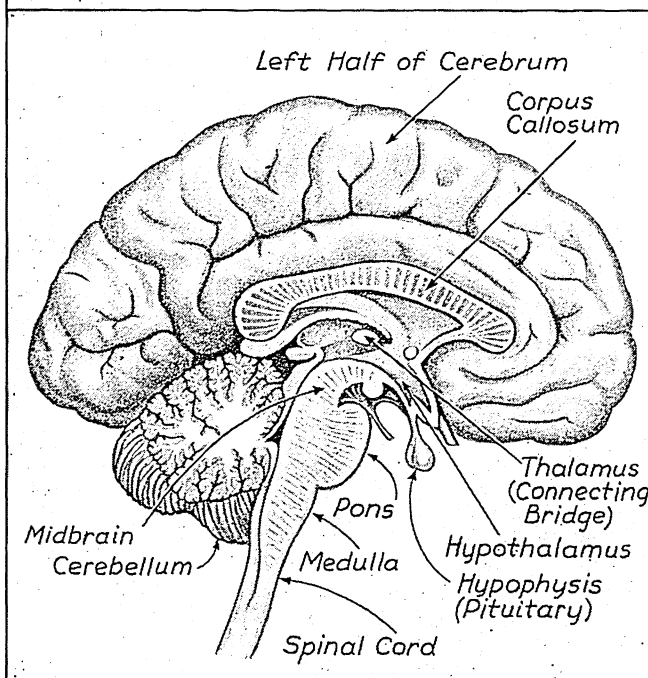
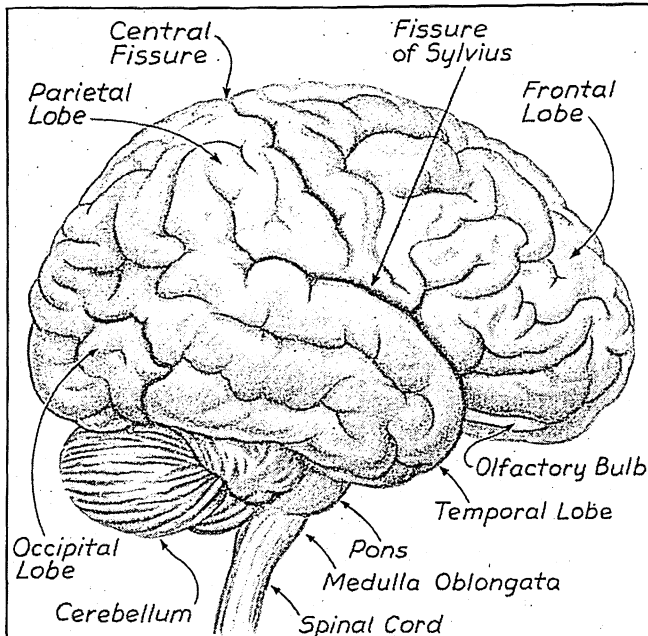
Weight (average)—*Man*: adult male, 1,500 grams or 3½ lbs.; 70 per cent water. Less in females and children according to body weight. *Highest Ape*: 600 grams (1¼ lbs.). *Elephant*: 4,500 grams (10 lbs.). *Whale*: 9,000 grams (20 lbs.).

Proportion to Body Weight—*Man*: Adult, 1/40; *Canary*: 1/12; *Whale*: 1/40,000.

Cells—Variously estimated at from 10 to 15 billion.

Miscellaneous—At birth human brain is 1/7 of total body weight; increases rapidly during childhood, attains maximum by 20th year. Largest known human brain (2,222 grams) belonged to an unskilled laborer; many talented individuals have had small or average-sized brains.

IMPORTANT PARTS OF THE BRAIN



The upper picture shows the human brain, as viewed from the right side. In the lower picture the brain has been cut down through the middle, and we see the inside surface of the left half of the cerebrum and the parts that connect the two halves or lie beneath them. The folds in the surface of the brain are called convolutions. They provide a greater area of cortex or gray matter than would be possible if the brain surface were smooth. They also divide the cortex into distinct parts called lobes. Each lobe is the seat of some large division of mental activity, as indicated on page B-222. The cerebellum coordinates complex muscular activities such as walking, swimming, and handiwork. The pons serves in part as a bridge between the two halves of the cerebrum. The medulla oblongata controls certain automatic, vital functions, especially breathing. The thalamus and hypothalamus control "states of mind" such as being awake or asleep, and emotional states such as being excited, calm, happy, or distressed.

when dressing. The cerebellum coordinates complex muscular movements, as in walking, swimming, or writing. The remaining parts in the base of the brain control "mechanical" aspects and activities of life, such as being awake or asleep, excited or calm, breathing, swallowing, and the like.

"Gray Matter" and "White Matter"

As explained in the article on Nerves, the brain, like all other masses of nervous tissue, is made up of *neurones*, consisting of cell bodies with their connecting fibers. The fibers, like telephone wires, serve only to carry messages; they would be useless without some one or something to "talk" over them. In nervous tissue, the cells correspond to talkers over telephone wires. They receive and send out all the impulses which enable the nervous system to do its work.

We can tell masses of cell bodies and fiber masses apart, because naked cells have a grayish color, while most fibers are white, owing to an outer sheath of fatty matter (*myelin*). In man's brain, most of the gray matter is on the outside of the cerebrum, while the inside consists of white fiber, with scattered masses of gray matter. The outside gray layer is called the cerebral *cortex* (Latin for "bark" or "shell").

We may well suspect that here is where man conducts his unique activities of thought, because all the internal masses can be matched in the brains of animals, but no animal can match man's huge mass of cortical gray matter. Many experiments have proved that the cortex is indeed the seat of conscious thought. Injury to the cortex impairs higher, conscious mental activity but does not affect the lower, more automatic functions. These results are reversed if lower parts of the brain are injured.

In addition to serving conscious thought, the cortex also receives reports from the outside world through the sense organs. These sensory reports circulate first through the lower parts of the brain and may result in automatic actions generated there, as described later. The cortex is where we perceive the "meaning" of sensations, and decide, if we like, to take some appropriate action. For example, a flash of strong sunlight through a window may cause us to blink by reflex or automatic action. At the same time, in the cortex we become consciously aware of the flash, and may decide to get up and pull down a blind.

Regions of Activity in the Cortex

Surgeons can even map out centers for different types of mental activity by stimulating different parts of the cortex with an electric current when the brain is exposed for an operation. Stimulating a sensory center, such as

the one for the foot, causes the patient to feel a tickle *in the foot* (not in the brain). Stimulating the motor center for the foot causes the foot to twitch. The brain itself feels none of this, because it is completely insensitive to pain. Headaches are felt in the meninges.

Other centers can be identified similarly. The more important ones are indicated in the accompanying pictures. Perhaps the most distinctive are the frontal lobe, where we do our planning, and the parietal lobe, which enables us to use language. These parts are much larger, relative to the rest of the brain, than they are in any animal; and the shape of the head shows this. The high forehead of man provides room for his frontal lobe; the skulls of the most intelligent of all animals, the apes, slant almost straight back from the eyebrows. Likewise the human skull, above and behind the ears, is relatively much broader than any animal's skull.

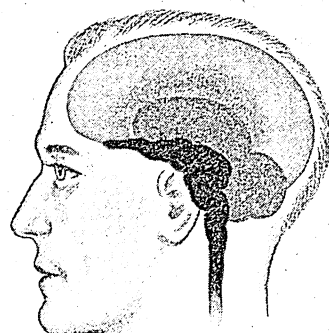
The left hemisphere of the cerebrum controls the right side of the body, and the right hemisphere controls the left side. This occurs because the long fibers which connect the cortex with all parts of the body cross over from one side to the other, in the "stem" of the brain above the spinal cord.

Reflexes and Emotions

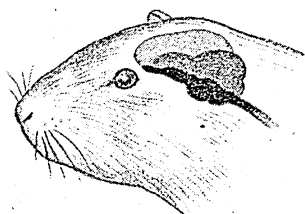
In many of its activities, the brain works like an automatic telephone exchange. A good example is the control of respiration. When we exert ourselves, we bring on an increase of carbon dioxide in the blood. As the blood presses through the "breathing center" in the *medulla oblongata* at the base of the brain, the excess carbon dioxide sets up an immediate reaction, and nerve impulses go out which speed up the heart beat and the breathing muscles (see Respiration). We are not conscious of the process, only of the results.

Such automatic responses are called *reflexes*. Somewhat akin to reflexes, but more complex, are the reactions called *emotions*. These reactions "key" the body to meet different situations. If danger threatens, for example, an emotional reaction stirs up body and mind to fighting pitch, and usually we "feel" rage or "a fighting mood" (see Emotions). These re-

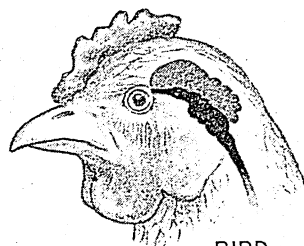
BRAIN DEVELOPMENT



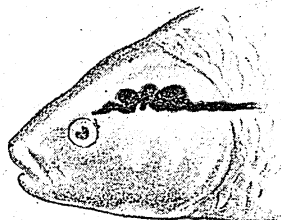
MAN



GUINEA PIG



BIRD



FISH

The corresponding parts of each of the brains are shaded alike. Notice how, from fish to man, the size of the upper brain structure increases in comparison with the lower. The text tells how this fact is reflected in animal behavior.

actions originate in the lower part of the brain, where the *thalamus* and the *hypothalamus* lie at the base of the cerebral hemispheres. They work in part through a small bean-shaped organ in this area called the *hypophysis* or *pituitary body*. This organ is also a control station for the glands that supply the blood with *hormones* (see Glands).

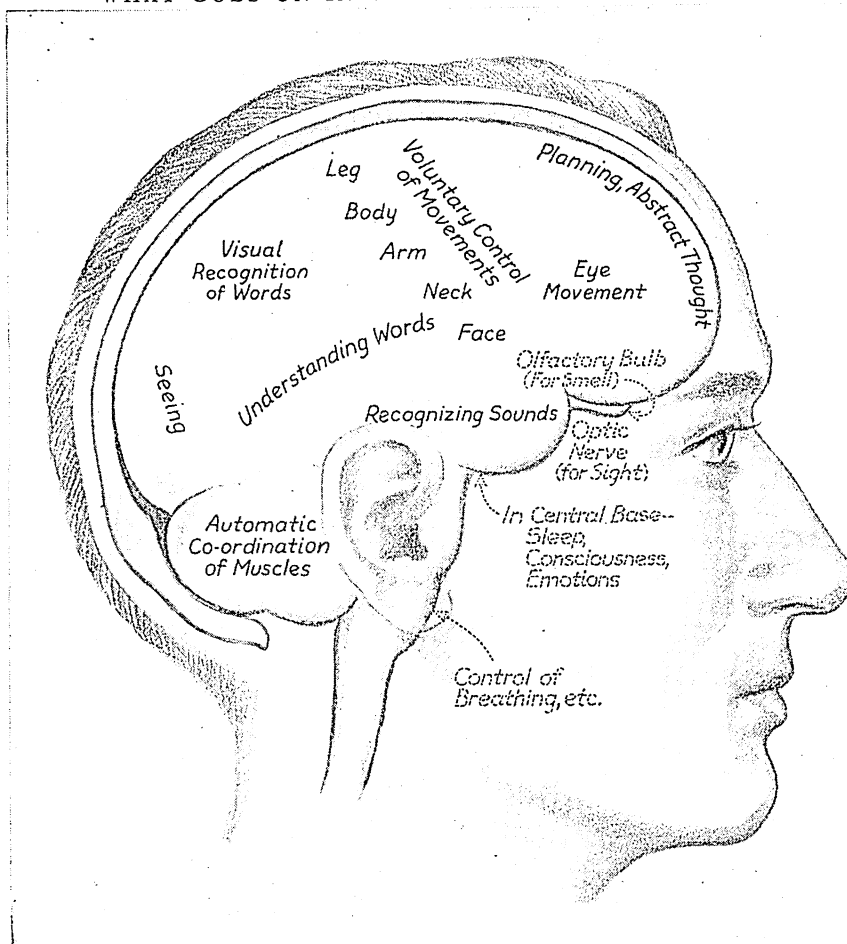
The smaller the upper brain structures of an animal, the more its behavior is dominated by reflexes. The brain of a fish, for example, consists largely of parts that correspond to the lower divisions of the human brain. The higher brain areas are represented only by a few small swellings. As a consequence, fishes act almost entirely through automatic reflexes (see Reflexes). They seem to learn very little. A fish that has escaped from a baited hook is likely to bite the same hook again a few minutes later.

Some of the most complicated and ingenious actions of animals have been explained as the result of chain reflexes. Nest building among birds illustrates the point. The bird accomplishes this through a "step by step" pattern, in which the completion of each step seems to act like a trigger to start the reactions leading to the next step. If the bird is interrupted for a day or two, it may be unable to take up again where it left off, but may have to start all over again from the beginning. Nest building is, of course, an inborn skill. A young female sets about building her first nest as deftly as an old bird. Experience plays no part in the process. Yet in some other aspects of their behavior birds do show more ability than fish to learn from experience. They

easily learn, for instance, that a scarecrow is harmless. The reason is plain when we examine a bird's brain and find the base of the cerebrum is highly developed.

Mammals, with still higher development of the cerebrum, respond in countless ways to experience and training. Their cortical layer of gray matter seems to act like a watchful bystander, presiding over the activities of the lower brain levels and intervening when something goes wrong. Experiences are recorded

WHAT GOES ON IN VARIOUS PARTS OF THE BRAIN



This diagram shows how the general functions of the brain are distributed in different areas. What may be called the mental and the voluntary functions have their seat in the cortex or gray matter coating of the upper brain (cerebrum). The automatic or reflex functions originate in the lower divisions of the brain. The dotted lettering refers to areas that are deeply buried within the brain structure. For the names of various parts of the brain, see page 220.]

in its cells, and while the lower mammals may not be able to "think over" these experiences (*see Memory*), they can act upon them. A "memory" of pain registers after a horse's first encounter with barbed wire. The next time the horse approaches barbed wire, the sight and smell of the wire stirs up this memory. Immediately the cortex flashes a warning to the lower levels, "Pain ahead! Shy away!" The leg muscles obey, and the horse avoids a repetition of its painful experience.

The Mystery of Consciousness

Now we come to a point where the comparison of the brain to an automatic telephone exchange breaks down. To explain human *consciousness*, we have to imagine an intelligent operator at work in the exchange. The brain of man and the brain of a lower animal receive sensations and generate actions in the same way but man is able to *think* about the sensations and *plan* the actions of the body in great detail. Man is aware of himself; he can imagine what he has never seen; he can form ideals for himself and strive toward

them; and he can exchange ideas with other men.

But we look in vain into the brain to find the seat of these distinctively human faculties. We feel and see them at work but we cannot find their mechanism. We are faced, therefore, with a mystery which science has not explained. We call it the conscious intelligence, the mind, the spirit.

The Nature of Brain Reactions

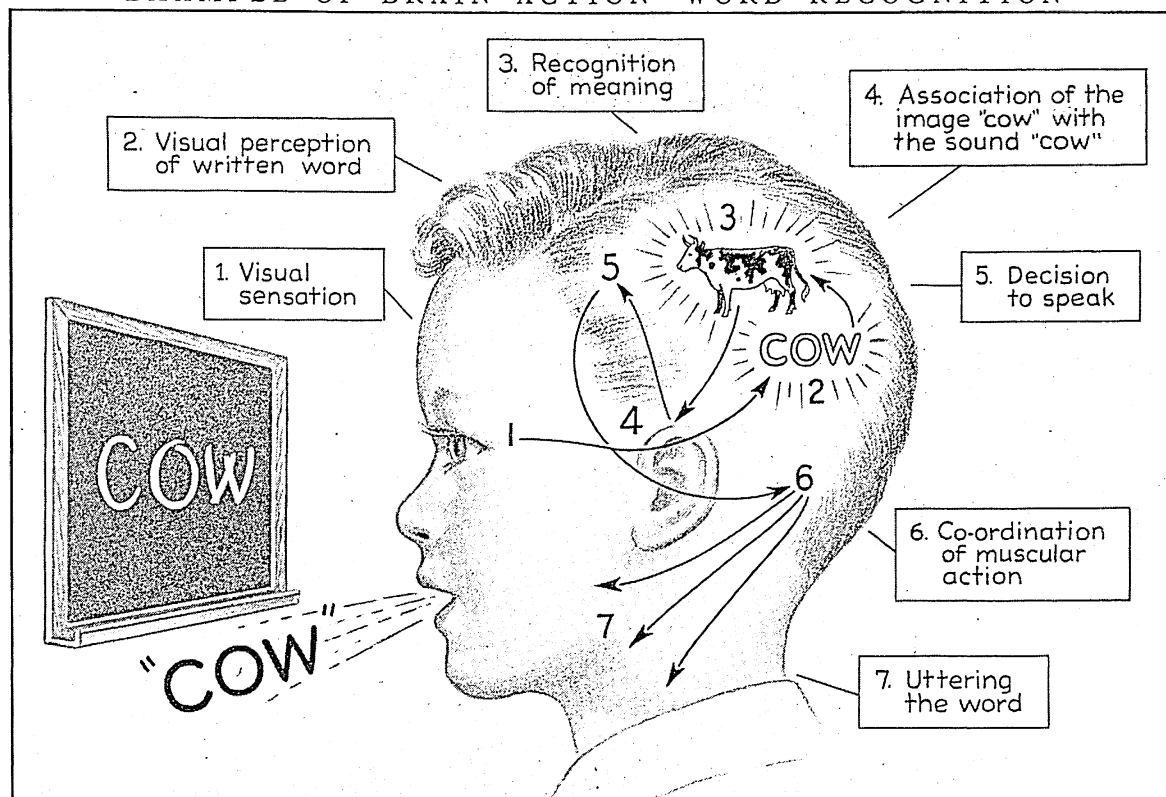
Though the central mystery of the human brain escapes analysis, we know a good deal about the cell and nerve activities that accompany thoughts and reflexes. The messages to and from the brain and within the brain itself do not run along the nerve fibers like ordinary electric currents passing through wires. The impulses consist of complicated electro-chemical interactions that travel along nerve circuits at comparatively low speeds—an average of about 230 feet a second.

The swiftness of the electrical reactions is offset by the slowness of the chemical changes involved.

Nerve circuits are composed of neurones. The vital, active center of each neurone is a grayish cell body, not more than 1/250 of an inch in diameter. Attached to it are two kinds of fibers, the many-branched *dendrites* and the *axon* with only a few branches. Nerve impulses enter the cell through the dendrites and are passed on toward the next neurone in the circuit through the axon. Between the axon of one nerve cell and the dendrites of the next cell is a gap called a *synapse*. It is at this point that the chemical reactions referred to above take place. The impulse coming through the axon seems to stimulate a hormone-like secretion in the gap, and this in turn sets up a new impulse in the dendrites on the other side of the gap.

This entire arrangement accounts for the fact that impulses can travel along nerve circuits in only one direction. Thus the sensory or *afferent* circuits that bring in messages to the brain are made up of neurones that have their axons toward the brain end.

EXAMPLE OF BRAIN ACTION—WORD RECOGNITION



This illustration suggests the complex interactions of various parts of the brain that take place when we see a word, recognize it, and pronounce it. The steps are numbered in the order in which they occur and the areas of the brain concerned in the operation are numbered in the same sequence. In the final step, the impulses leave the brain and go to those muscles of chest, throat, and mouth that are used in speaking.

On the other hand, the motor or *efferent* circuits that carry messages away from the brain consist of neurones arranged the other way around (see Nerves).

The efficiency of transmission over many synapses seems to improve with use. This phenomenon helps to account for our fumbling uncertainty when performing an unfamiliar movement, and for the ease and certainty which come with practise. It may also enter into our ability to perform mental tasks more readily as education progresses.

How Complex Reactions Start

The branching of the neurones at both the incoming and outgoing terminal explains some of the more complex activities of the brain and the nervous system. A good example is the reaction of a person to burning a finger. A sensory circuit transmits the mainline message and the finger jerks away by reflex action. But axon branches along the circuit also send "side" messages across other synapses to other brain areas. One such message, reaching the speech center, may cause a cry of pain. Another, reaching the "finger control center" in the cortex, may lead the person to put his finger in his mouth. So also the emotional center might be stirred, and lead him to kick angrily at the offending hot object. Social training may enter into the reaction. A child probably would weep with-

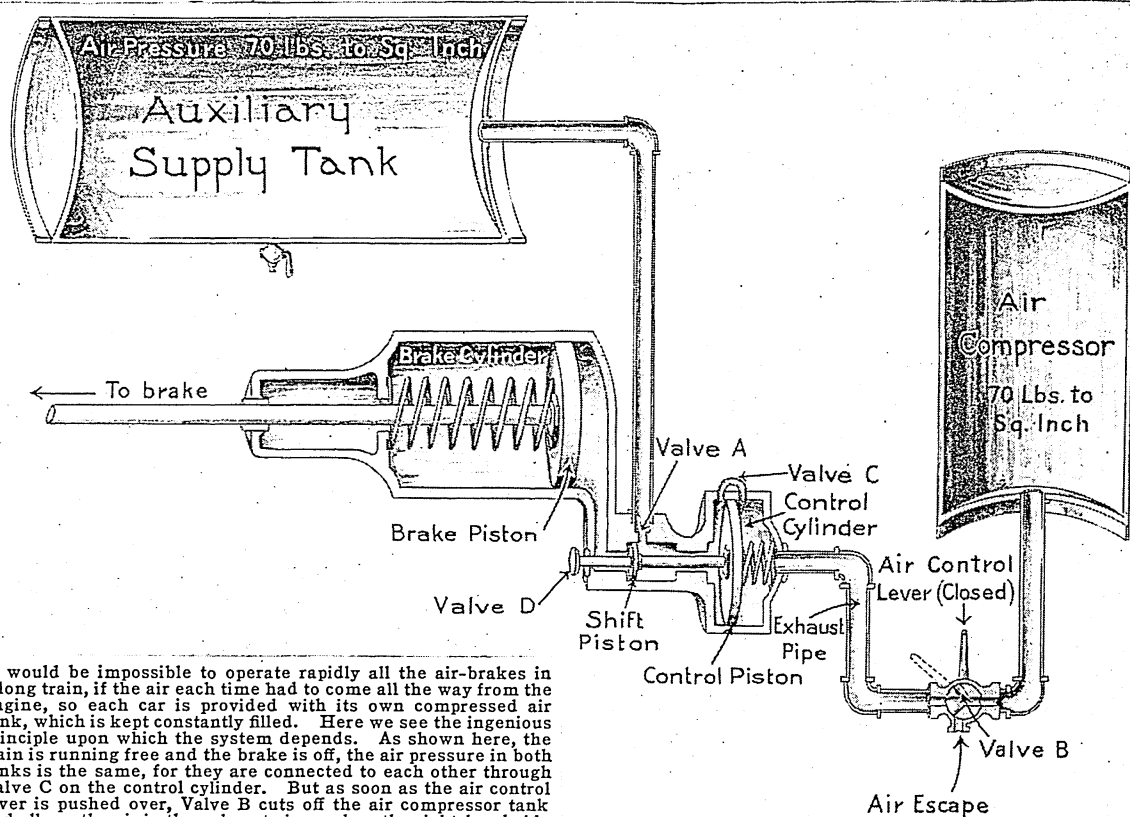
out restraint. But the "social training" region in the cortex of an adult might say, in effect, "No, you mustn't cry." And all this would be done by the simple activity of neurones receiving and sending nerve impulses, because branches from the main path may lead far and wide among the billions of brain cells and stir up a complex pattern of related reactions. Some, as we have seen, would be almost uncontrollable reflexes. But others would be determined by "habit patterns" (see Habit).

The so-called "electrical brain waves" measured by the instrument called an *encephalograph* appear to have no relation to any particular sensation reaction or train of thought. Indeed, the waves (about 10 per second) occur most strongly when a person is resting, and tend to disappear when he reads a book. Variations in the waves have proved of some value, however, in diagnosing brain diseases.

Diseases of the Brain

Brain diseases can be caused by injuries, infections, or the growth of tumors. *Apoplexy* is a sudden loss of consciousness, which occurs when a blood vessel breaks in the brain, and escaping blood provides pressure enough to cause stupor. This usually happens when advancing age makes the arteries brittle. Patients often survive one or more attacks; but they

HOW A BLAST OF AIR STOPS A TRAIN



It would be impossible to operate rapidly all the air-brakes in a long train, if the air each time had to come all the way from the engine, so each car is provided with its own compressed air tank, which is kept constantly filled. Here we see the ingenious principle upon which the system depends. As shown here, the train is running free and the brake is off, the air pressure in both tanks is the same, for they are connected to each other through Valve C on the control cylinder. But as soon as the air control lever is pushed over, Valve B cuts off the air compressor tank and allows the air in the exhaust pipe and on the right-hand side of the control piston to escape suddenly. Before any great quantity of air can run out through Valve C, the pressure on the left side of the control piston forces this piston to the right, closing Valve C. This pulls the shift piston across Valve A, closes Valve D, and allows the air from the auxiliary supply tank to run into the brake cylinder and drive home the brake piston, bringing the car to a stop. With this method of applying the brakes by letting air out from the connecting pipes, a car or any part of a train which breaks away from the engine is at once brought to a halt.

may be left partly paralyzed. *Aphasia* is loss of the power of speech or of ability to understand speech; *amnesia* is loss of memory. These conditions are usually caused by lesions in the areas of the brain that control the faculties in question. Injuries and certain degenerative diseases may also cause the kind of brain disorder that is classed as insanity.

BRAKES. Cornelius Vanderbilt, the railway magnate, fixed a quizzical gaze on George Westinghouse, the inventor.

"Do you mean to tell me," said he, "that you can stop a railroad train by *wind*?"

"Well," replied Westinghouse, "since air is wind, yes!"

"Nonsense!" exclaimed Vanderbilt. "I have no time to waste on such a fool idea!"

And the inventor, discouraged but determined, was obliged to look elsewhere for aid. Eventually he found it. Other men of wealth, among whom were Andrew Carnegie, Ralph Bagley, and Robert Pitcairn, recognized the merit of his invention and equipped a train according to his plans. As the old-fashioned train rattled over the rails near Pittsburgh, the first trial of the air-brake took place in 1868.

The test was a complete success. Westinghouse had made good his boast that with this automatic air-brake he could stop a train in its own length—stop it almost as abruptly as the sea-gull, swooping down from on high, checks its descent with tail and wings and settles gently on the water.

Almost immediately the Westinghouse brake replaced the old hand-brakes on all fast passenger trains in this country and the rest of the world. Later it was applied to freight trains and trolley cars, so that today the once familiar picture of the brakeman struggling with frantic vigor at wheels and levers is seen no more, except on a few unimportant lines which still operate with their old equipment.

Without the air-brake, the terrific speeds of modern trains would be impossible. Even with the light trains and low speeds of the early days many accidents were caused by the ineffectiveness of the hand-brakes. It was largely the sight of such an accident that set Westinghouse experimenting to devise a brake which could be applied effectively and at about the same instant to every car in a train.

He succeeded so well that the action of his air-brake takes place at the last car of a 50-car train in

$2\frac{1}{4}$ seconds after application at the engine. The Westinghouse brake is operated by an air pump on the engine, which sends compressed air back to the tank of each car through a system of pipes and couplings. How the brakes of each car are applied by releasing the pressure from the engine is explained by the diagram on the opposite page. On the older railway cars the braking power acts through metal shoes that press on the outside rims of the wheels. On the newer cars the brake shoes press against disks or cylinders attached to the axles.

A wagon brake consists of a wood or metal shoe pressed against the wheel rim by a push of the foot on a lever. The

brakes of rubber-tired vehicles work against brake drums fastened to the inner side of the wheels. Some automobiles and other engine-driven devices have brakes that are applied to the drive shaft, flywheel, or other revolving part of the driving mechanism. Street cars are sometimes supplied with "slipper" brakes that press down on the tracks. The "drag" of powerful magnets, set close to the tracks without touching, helps to stop many of the light, streamlined trains. Since they do not depend on friction, these magnetic brakes work well even when the tracks are slippery.

The commonest brakes are those in which levers magnify the force exerted by hand or foot. But even more effective is the application in "hydraulic brakes" of the principle of liquid pressure, where a moderate push on a small piston creates a powerful action by a larger piston (*see Automobile; Hydraulic Machinery*).

The GIANT REPUBLIC of the AMAZON BASIN

BRASIL, UNITED STATES OF. The most striking thing about Brazil is its size. It is the largest of the South American republics, sprawling across more than 45 per cent of the entire continent. It is larger than the United States, excluding Alaska, and is three-fourths as large as all Europe, with an area of about 3,286,000 square miles. On the north and west it borders every South American country except Ecuador and Chile; on the east it fronts the Atlantic Ocean for about 4,000 miles. Its estimated population of 43,000,000 is about half that of all South America. Apart from its immense size, Brazil is unique in many other respects.

It is the only Portuguese-speaking country in South America, having been claimed for Portugal by early adventurers seeking a route to the East Indies. A second striking fact is that almost all of the country lies within the tropics. As a result the greater part of the area is still undeveloped and sparsely settled; yet almost half of the people are white. Of the remainder, more than a third are Negroes or mixtures of Negro and white, while only a fraction of one per cent are Indians. A third and perhaps most notable feature is that the southeastern portion of the country is occupied by a great plateau, where elevation reduces the tropical heat. There, in the highlands, are the rolling pasture lands, the plantations, and the bustling towns and cities which are home to most of the Brazilian people. There too are most of the nation's steadily growing industries.

Mountains and Rivers

On a map Brazil looks like a vast inverted triangle. All of the triangle lies within the tropics except for the southern tip, about a twelfth of the country,

Extent.—Greatest extent from north to south and from east to west, about 2,700 miles; Atlantic coast line, about 4,000 miles. Area, about 3,286,000 square miles, more than 45 per cent of South America.

Population.—About 43,000,000 (estimated); about 60 per cent in the central and southern highlands.

Highlands, Lowlands, and Waterways.—Lowland Amazon basin in north and west, great plateau in south and east, elevated plains in extreme north. Amazon River and its more than 200 tributaries, the most important of which are the Negro and Madeira; São Francisco; Tocantins; Paraná; Paraguay; and Uruguay.

Political Divisions.—States of Alagoas, Amazonas, Bahia, Ceará, Espírito Santo, Goyaz, Maranhão, Matto Grosso, Minas Geraes, Pará, Parahyba, Paraná, Pernambuco, Piauí, Rio de Janeiro, Rio Grande do Norte, Rio Grande do Sul, Santa Catharina, São Paulo, and Sergipe; Federal District and Acre Territory.

Chief Cities.—Rio de Janeiro (capital, 1,800,000); São Paulo (1,000,000); Recife (Pernambuco) (510,000); São Salvador (Bahia), Porto Alegre, Belém (Pará) (over 300,000); Bello Horizonte, Fortaleza (Ceará), Santos, Campinas, Maceió, Niterói (Nichteroy), Juiz de Fora, Curitiba, João Pessoa, Pelotas (over 100,000); Manaus (Manaus) (over 98,000).

Exports.—Coffee, cotton, cacao beans, hides, oilseeds, oranges, beef, tobacco, rubber, yerba maté.

Other Products.—Corn, sugar, rice, timber, carnauba wax; coal, manganese, gold, diamonds, and other gems.

Imports.—Machinery, wheat, iron and steel products, motor cars, coal, coke, chemicals, gasoline, paper, and wood pulp.

which extends south of the Tropic of Capricorn. On every side the triangle is rimmed with mountains. In the east the Serra do Mar and related ranges rise sharply from the Atlantic Ocean and sweep westward to the interior at an elevation of from 1,000 to 3,000 feet. This is the great Brazilian plateau, which comprises the southern and eastern part of the country. It occupies about one-half of the area and has nine-tenths of the people. In the west the interior low-

lands rise to meet the Andes Mountains outside the Brazilian frontier, and in the north a stretch of elevated plains and foothills leads into the Guiana Mountains—the highlands of Brazil's northern neighbors. In the interior, bounded on every side by these mountain ranges, is the low, forested, swampy Amazon basin, occupying about a third of the country.

The greatest river of Brazil and of the world is the mighty Amazon, which with its many tributaries flows through the dense forests of northern Brazil and drains an area of about 2,500,000 square miles (*see Amazon River*). In the south are the Paraguay, Paraná, and Uruguay rivers, all of which flow out of Brazil and form the Plata River (*see Plata River*). In addition, a number of rivers flow independently from the eastern plateau to the Atlantic. Of these the most important are the São Francisco and the Parahyba ("bad river"—not to be confused with Parahyba, the name of a state).

Central and Southern Highlands

The heart of Brazil is the portion of the great plateau which stretches along the Atlantic coast from the state of Minas Geraes to the southernmost tip of the country at Rio Grande do Sul. Though occupying only a fifth of the total area, these southeastern

VARIED EXPANSE OF SOUTH AMERICA'S LARGEST COUNTRY



Brazil is the only nation in the world that extends from the Equator into the middle latitudes. North and west lie the lowlands of the Amazon basin. East and south stretch mountains and plateaus, with the principal cities on the southeast coast.

highlands contain over half of the people, and most of the farms, factories, railways, and mines. Midway on the coast of this region is Rio de Janeiro, the country's magnificent capital and the second largest city in South America (see Rio de Janeiro).

The healthful climate of this highland region accounts for its predominantly white population. The southern part lies in the middle latitudes, and in most of the remainder the height, averaging about 2,500 feet, breaks the tropical heat. Hence the climate, ranging from temperate to subtropical, is more varied and pleasant than in the rest of Brazil. In the northern reaches of Minas Geraes the temperature ranges from an average of about 59° F. in July (the

coldest month) to about 81° in January (the warmest month). In Rio Grande do Sul, at the southernmost tip of the country, the temperature is about 56° in July, and about 80° in January. The average annual temperature for the entire highland region is about 68°. Rainfall is well distributed throughout the year, with an average annual precipitation of about 51 inches.

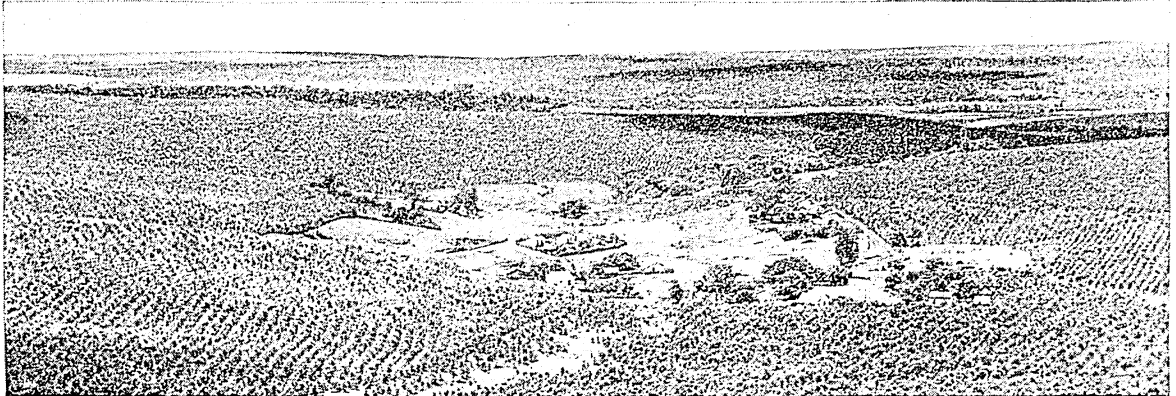
Life on the Fazendas

The deep rich soil, the temperate to subtropical climate, and the abundant rainfall make the highlands ideal for raising coffee. This region is indeed the coffeepot of the world, producing two-thirds of the entire supply (see Coffee). In the northern states

of São Paulo and Minas Geraes, cotton grows in great abundance. Although production is relatively small, because of inefficient methods and the competition of coffee, this cotton region is even more fertile than the cotton belt of the United States. The highlands are also the center of Brazil's extensive stock-raising industry. All this fertile, rolling land is splen-

The division of land into great estates is a survival from the days when Brazil belonged to Portugal. In an effort to populate the country, the Portuguese monarch granted enormous domains to white settlers, who worked the land with the aid of native Indians and of Negro slaves imported from Africa. And so in Brazil today there are estates larger than all Eng-

A COFFEE FAZENDA IN SÃO PAULO



In the midst of miles of coffee trees lie the homes of the *colonos*, or agricultural laborers, who live on the great fazendas much as medieval peasants lived on the feudal manors of Europe. Such a plantation may have several million trees.

did for pasture, and the southernmost state of Rio Grande do Sul is particularly noted for its large herds of sheep and thoroughbred cattle. Other products are corn, sugar, beans, rice, wheat, and Paraná pine. There are extensive deposits of iron ore and manganese, and some gold and diamonds are produced. Black diamonds, called *carbonadoes*, which are harder than ordinary diamonds and are used for cutting substances like rock, are mined in the state of Bahia and exported all over the world.

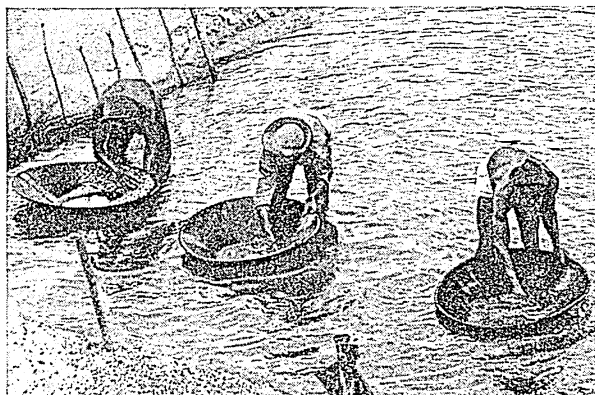
But though other products, notably cotton and live stock, are of growing importance, coffee is still king in the highlands. A typical great estate (*fazenda*), extending to perhaps 30,000 acres, may have three or four million coffee trees. A small area, perhaps a thousand acres, is devoted to cotton and pasture land.

Five thousand people may be employed, most of whom are *colonos*, or agricultural laborers under contract to the owner. Life on such a fazenda resembles that on a manor of the Middle Ages. With its own shoemakers, butchers, bakers, and tailors; its own sawmills and foundries; and its private railroad linked with the main line—the fazenda is a world in itself. There is a school, a church, and a hospital; even moving pictures are provided.

land. The average size of an agricultural holding is 660 acres—or nearly five times the size of the average United States farm. With 70 per cent of Brazilian labor engaged in agriculture and stock raising, the concentration of good land in the hands of a few is a major national problem.

The tendency in recent years, however, has been to break up the great fazendas into small holdings. To promote this and also to attract colonists, Brazil has launched the most extensive settlement scheme in South America. The state and federal governments, as well as private companies, have sold small farms to immigrants and native Brazilians, who pay for the land over a period of time. Though many of the immigrants, after working the land for a brief period, returned to their native countries, large numbers,

WASHING GRAVEL FOR DIAMONDS IN BAHIA



In diamond production Brazil is second to Africa. It is the world's chief source of black diamonds, or *carbonadoes*, used in the manufacture of diamond drills, cutters, and abrasives. Many of the stones are found in river bottoms,

aided by the government, remained as settlers. All over the coastal region, and particularly in the south, are found clusters of farms owned by colonists from Italy, Germany, Switzerland, Russia, and other European countries.

The Equatorial Jungle

From the pleasant rolling coffee country we now travel northwest across the state of Matto Grosso to the interior—and there we are plunged into a

steaming jungle as hot and thick as the Congo of Africa. This is the Amazon basin, a thick swathe of forest and swampland (*selva*) extending from the foothills of the Andes in the west to the mouth of the Amazon River on the Atlantic. Lying entirely within the tropics, this lowland area is hot throughout the year; and over its vast extent there is little variation from the average annual temperature of 79° F. There are wide seasonal differences in rainfall, however, with drenching rains from December through April,

A HOME IN THE TROPICAL FOREST



Out of the dense vegetation at the river's edge an Indian family has hacked a clearing and built a primitive hut of brush and leaves as a shelter against torrential rains. The canoe is a hollowed-out log.

and lighter rains from May through November. In much of the basin, the annual rainfall is more than 80 inches—the largest area in the world with such a heavy precipitation. In the rainy months a large part of the region is flooded. The only relatively dry area is in the extreme north, where the mountains cut off the moisture from the northeast trade winds.

Though the Amazon forests occupy a large part of the country, they produce only a small part of the national wealth. They supplied most of the world's rubber until about 1910, when competition of plantations in the East Indies began to ruin the Brazilian industry. Rubber is still the chief product of the jungle, but now it accounts for less than 2 per cent of the nation's exports (*see Rubber*). Brazil nuts are an important item of commerce; and the region also produces babassu nuts and other oilseeds, balata, cacao, timber, and small food crops used locally.

One forest product deserving special mention is the red dyewood used in making dyes and fine furniture. This was the basis of Brazil's oldest industry and gave the country its name. For when Portuguese explorers

first discovered Brazil, they loaded their ships with the precious wood, the Portuguese name for which is *brasil*. The name Santa Cruz, as the country was then called, was in time changed to Brazil—the "land of red dyewood."

Life in the Amazon Basin

More people live in Philadelphia than in all the vast region of Amazonia. Because of the heat, the rain, the humidity, and the mosquitoes, white people have generally avoided the Amazon jungles, so that they are inhabited mainly by Indians and *mes-tizos* (people of mixed Indian and white blood). Rich and fertile as the land is, not enough food is grown to support the people that live in the few settlements, and most of their food must be imported.

Life in the jungle is so different from life in the great cities and ranches of the highlands that it is hard to believe there could be such variation within the borders of a single nation. The Indians of the Amazon live along the streams, hunting or fishing for food; or in small jungle clearings, where they cultivate the land in primitive fashion and move on when the soil is exhausted. For shelter they select spots along the rivers, as high as possible, to be above floods in the rainy season. There they build huts thatched with leaves to keep out rain, insects, and predatory animals. Their furniture is limited to tools, cooking utensils, and hammocks, which are plaited like baskets from long fibers. The remote tribes wear clothing only for ornament and to carry magic charms, rather than to provide protection.

For travel through the thick woods the Indians cut narrow trails when they must; otherwise they move by water in long canoes made by hollowing out tree trunks with fire. Since bows and arrows are awkward to use in the dense forest, some tribes hunt with darts shot from blow-pipes. To bring down large game, the darts are tipped with poison. The women prepare food and drink from the poisonous roots of the cassava plant (*see Tapioca*). A great hazard to life in the jungle is the prevalence of tropical diseases. In recent years the Rockefeller Foundation has reduced this hazard by inoculating thousands of natives against yellow fever.

Other Sections of Brazil

Although the southeastern highlands are the most highly developed section of Brazil, and the Amazon basin the most famous, there are two other large regions. One of these is the northern part of the great plateau, extending north along the Atlantic coast from the state of Minas Geraes to Rio Grande do Norte, and bounded on the west by the Parnahyba River. This section is hotter and drier than the southern highlands. Except near the coast and in a few interior areas, rainfall is either too scanty or too irregular for agriculture. Droughts are frequent, and much of the country is semidesert scrubland (*caatinga*).

Most of the farming is done on irrigated lands or in the less dry regions along the coast. Cotton, sugar, and tobacco are the most important crops. Other products include cacao beans, carnauba wax, manioc, and fruits. Goats thrive in this hot arid climate, and so these northeastern states contain about two-thirds of the goats of Brazil.

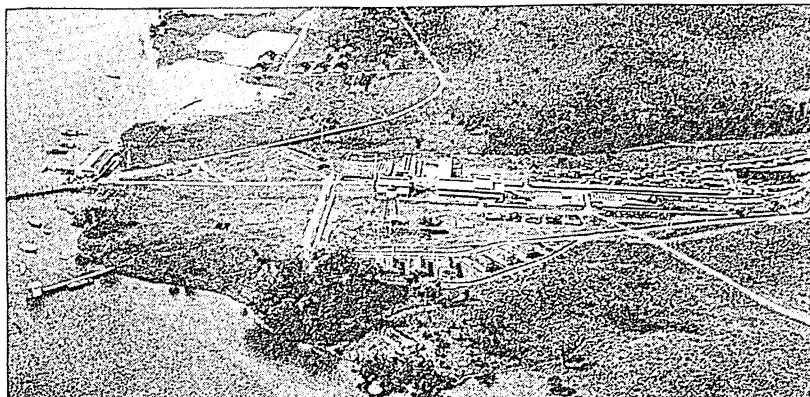
The fourth division, the great interior region of the southwest, which includes the greater part of the states of Matto Grosso and Goyaz, spreads over about a fourth of the entire country but contains only about 2 per cent of the population. This is the westernmost extension of the great plateau, sloping gradually from the eastern highlands to a lowland plain bordering the Amazon basin. The interior suffers under tropical heat, but in the east, at Goyaz, the greater height produces a cool bracing climate. Here, in the heart of the highlands, the government has set aside an area of 5,560 square miles as the site of the new federal capital.

The chief drawbacks to the economic development of the southwestern region are its inland location, its inadequate river and rail transportation to the sea, and the hot climate of much of the area. Hence only about 3 per cent of the farms of the country are in this area. Most of the cultivated land is devoted to enormous cattle ranches, averaging over 5,000 acres. Small quantities of gold and manganese are mined.

The People: Their Background and Culture

About half of the people of Brazil are white. The large white population results from the influx of immigrants during the century after 1820, when more than four million people poured into the country. The greatest number came from the mother country Portu-

AN AIR VIEW OF FORDLANDIA RUBBER PLANTATION



The Ford Motor Company owns some 2,500,000 acres of land along the Tapajós River, a tributary of the Amazon. At Fordlandia, the original development first planted in 1929-30, about 6,500 acres are now producing rubber for American automobile tires.

gal, and there was heavy immigration from Italy, Spain, and Germany. The non-white half of the population is a medley of races. There is a large Negro population—about 14 per cent—due to the importation of slaves from Africa; and about a fifth of the people are a mixture of Negro and white. The mestizos constitute about a tenth of the population, and the native Indians, who are gradually vanishing, number only about 100,000. In recent years there has been a large influx of immigrants from Japan. In 1934 immigration for all nationalities was restricted by law, but these restrictions were relaxed in 1940, after the outbreak of war in Europe.

About 60 per cent of the people—mainly whites—live in the fertile region of the central and southern highlands; about 35 per cent—largely Negroes and mestizos—live in the tropical northeast; and the remainder, comprising most of the Indians, are scattered over the immense, sparsely settled Amazon basin.

Despite its variety of races, Brazil has virtually no "color problem." The Negroes, who were freed from slavery in 1888, are not discriminated against in economic or social life. Most of the European settlers

who have come during the last hundred years or so have been assimilated with ease. But a problem is presented by the tendency of some recent immigrants, particularly those from Germany and Japan, to settle in groups and maintain their own language and customs.

Education and Religion

Between 65 and 75 per cent of the people cannot read or write. This enormously high percentage of illiteracy is ascribed partly to the large number of immigrants and partly to the failure of the government, until recently, to provide adequate educational opportunities. Now both the federal government, which controls secondary schools,

CUTTING THE GIANT PEROBA IN THE JUNGLE OF ESPIRITO SANTO



The peroba is an important timber tree with a very hard rose-yellow wood, common in many parts of the country. The forests of Brazil cover perhaps a billion acres. They produce a great variety of valuable woods, nuts, drugs, dyes, and tanning extracts.

and many of the state governments, which control primary and rural education, are striving for better and more extensive instruction. The national university is at Rio de Janeiro, and there are other universities in the leading states. The majority of the people belong to the Roman Catholic church, but there is a wide variety of other religious creeds, which enjoy freedom of worship.

Uses and Possibilities of the Land

Two-thirds of Brazil's vast area is unoccupied, except for a few Indian tribes with occasional small settlements. Only about one-fifth of the area is devoted to farms.

About 75 per cent of the farm land is pasture and brush; 6 per cent is forest or woodland; and only 19 per cent is planted to crops. The major crop lands occupy some 32,000,000 acres, more than half of which is planted to coffee and corn, and most of the remainder to rice, cotton, sugar, and tobacco. Vast pasture lands support more than a hundred million animals, mostly cattle, swine, and sheep; and live-stock raising has become one of the country's major industries. The products of the forest, exclusive of the Amazon jungle, are of little value—chiefly Paraná pine, used for lumber and railway ties, and *yerba maté*, from which the Brazilian national drink is made.

But only a tiny part of the great treasure house of Brazil has been opened. Brazil has immense deposits of iron ore and manganese, and scattered deposits of gold, diamonds, and other precious metals. Yet the value of mineral production for the entire country is smaller than that for some single mines in Chile and Peru. The climate and soil are unsurpassed for growing cereals, fruits, sugar, cotton, flax, and dozens of other crops—yet 80 per cent of Brazil is still unfarmed and much always will be. Industry, too, although progressing rapidly, has reached nowhere near the development warranted by the country's great size and resources. Brazil is indeed in many respects a pioneer land which must be peopled with settlers and girded with railways for the country to develop into a great agricultural and industrial nation.

What Brazil Buys, Sells, Manufactures

Coffee is the measure of Brazil's prosperity. For almost half a century it has constituted more than half

of the total exports and in some years as much as three-fourths. The very abundance of coffee tends to reduce its price, with disastrous effects on the nation's economy. In 1931 the government levied a coffee export tax, using the revenue to purchase—and destroy—millions of bags of low-grade coffees; but Colombia and Venezuela took advantage of this restriction to sell their coffee more cheaply on the world market. In 1937, with financial panic impending, Brazil reduced the export tax. The failure of efforts to stabilize the price of coffee at a profitable level has caused the government to launch a program for diversified crops.

Cotton production is being expanded, and exports of cotton are already measured in millions of tons each year. Outgoing ships are loaded also with cacao, oilseeds (babassu and other nuts), hides and skins, carnauba wax, frozen meats, oranges, rubber, tobacco, *yerba maté*, timber, rice, and sugar. Other exports are bananas, pineapples, Brazil nuts, manioc, manganese, diamonds, opals, asbestos, and bauxite.

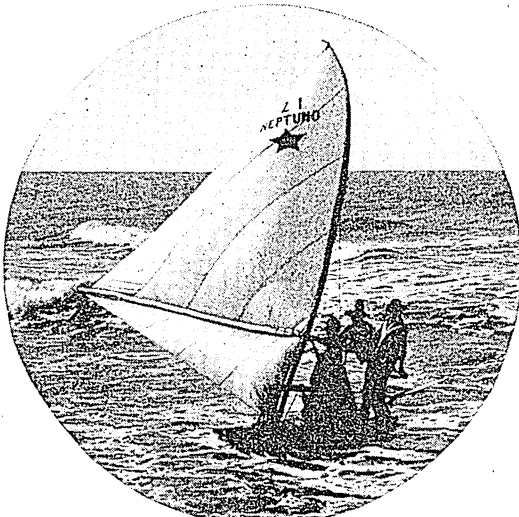
At the outbreak of war in Europe in 1939, the United States, Great Britain, and Germany provided the bulk of Brazil's import and export trade. Through barter deals, Germany's trade with Brazil had been increasing before the war, but it received stiff competition from the United States and Great Britain. The major Brazilian imports are machinery and equipment, wheat, iron and steel, automobiles, fuels, and prepared drugs. The machinery is used

largely by the factories of the southern states, notably São Paulo, which alone accounts for about half of the nation's industrial production. Dating largely from the World War of 1914–1918, when normal sources of supply were cut off, and aided subsequently by British and American capital, Brazilian industry is making great strides. The leading products are textiles, chiefly of cotton, but also of wool, silk, and rayon. Other important products are iron and steel goods, chemicals, hats, shoes, paper, and rubber goods.

Transportation and Communication

The further development of both industry and agriculture is bound up with improved transportation. With the interior cut off from most of the coast by almost impassable mountains, the rivers are still the only means of communication for fully half of the country. The Amazon, the Tocantins, the Parnaíba, and the São Francisco in the north and east, and the Paraguay, Uruguay, and Paraná in the south—and the many tributaries of these great rivers—furnish 10,000 miles of waterways navigable by large steamers, and 20,000 more open to boats of light draft. In the period when Brazil furnished most of the world's rubber, the rivers were the only means of access to the rubber forests of the interior; and the steam-

A SAILING RAFT OF THE NORTHEAST COAST



In these small rafts fishermen sail far out to sea and are often gone for days at a time. Their exploits are the themes of popular songs, for their boldness is greatly admired.

ers which ply between important points on the rivers are still vital to the nation's commerce.

But the most important means of transportation in modern Brazil is its railway network of more than 20,000 miles, most of which is concentrated in the central and southern highlands. More than half of the mileage is owned by the federal government; about a third by private companies, mainly British; and the remainder belongs to the states. The two best-known lines are the British-owned São Paulo railway, which transports coffee to the sea; and the Madeira-Mamoré railway, the only important one in the Amazon region.

There are fewer than 80,000 miles of roads in the country. Only about 1,000 miles of these are surfaced and the majority of all the highways are in the central and southern states. Road building was almost entirely under state control until 1937, when a National Highway Department was appointed to construct interstate roads. Because of the difficulties of building highways and railroads, air transportation has been well developed. There are 35,000 miles of air routes in the country, linking all the principal cities and extending 1,000 miles up the Amazon to Manáos. International air lines link Brazil with European, Latin American, and North American cities. Planes from Miami, Fla., reach Rio de Janeiro in only a little more than two days. The telegraph, telephone, and radio systems are privately owned, but the government controls the postal system and operates some telegraph lines and several radio stations.

Cities of Brazil

Most of the large cities are seaports. Rio de Janeiro, second largest city in South America, is the chief port. São Paulo (São Paulo), center of agriculture and industry, is a humming metropolis, with parks and fine residences. Lying in the coastal highlands about 40 miles from the sea, São Paulo sends its coffee by rail to Santos, the world's largest coffee port. São Salvador (Bahia), a shipping center for coffee, cacao, and tobacco, still contains many of the impressive old buildings and fortifications which date from its early history as a capital of Brazil. The surrounding region is the home of the seedless orange, and it was from here that the United States Department of Agriculture first obtained trees.

Porto Alegre (Rio Grande do Sul) is the principal city of the far south, a focal point for this rich agricultural region. Recife (Pernambuco) is one of the chief shipping ports for sugar. Belém (Pará), at the mouth of the Amazon, was once a great rubber port. Ocean steamers travel from Belém nearly a thousand miles up the Amazon to Manáos (Amazonas), a shipping port for forest products. Manáos is a brilliant city and has continued to grow despite the decline of the trade in rubber. On the Tapajóz River, midway between Belém and Manáos, lie the

huge 2,500,000-acre rubber concessions called Fordlandia and Belterra which are being developed by the Ford Motor Company.

Literature, Music, Painting

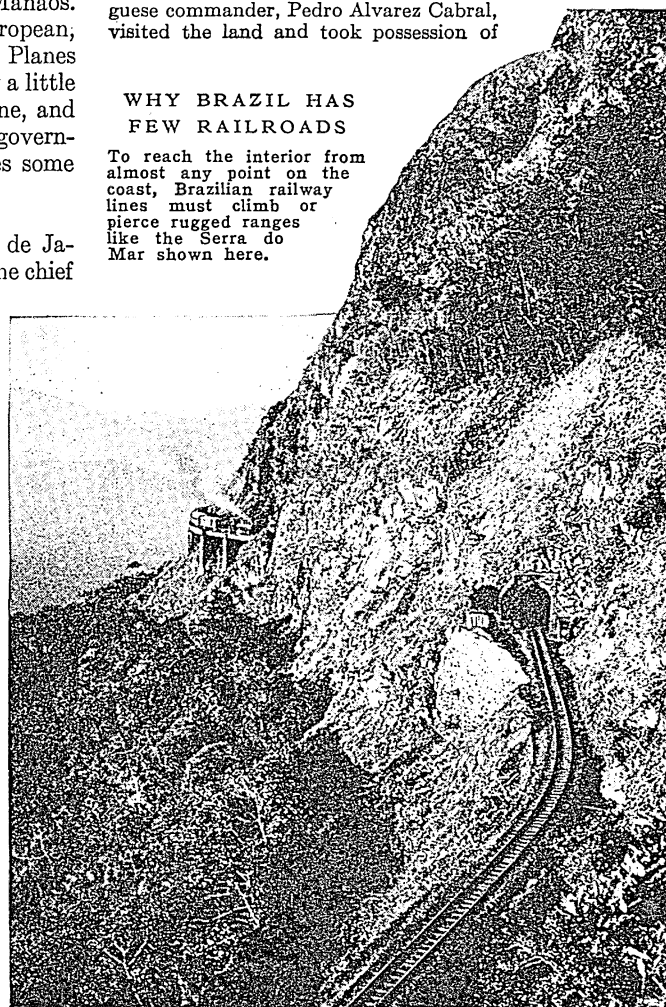
Set apart by language and by its dependence on a Portuguese rather than a Spanish cultural tradition, Brazilian literature is unique in Latin American writing (see Latin American Literature). Occupying a high place in the world's press is Rio de Janeiro's *Jornal do Commercio*, a newspaper which has sponsored many worthy Brazilian writers. In music and painting, as in literature, Brazil suffered from its thin cultural inheritance from the mother country. Yet Brazil has produced perhaps the greatest Latin American composer, Antonio Carlos Gomes (1839-1896), whose opera 'Guarany' won world-wide fame. Historical and religious subjects held the greatest appeal for the painters, notably Pedro Americo, Victor Meirelles de Lima, and Candido Portinari.

History and Government

Brazil, some historians believe, was discovered in 1500 by a companion of Columbus, the Spanish explorer Vicente Yáñez Pinzón. The same year a Portuguese commander, Pedro Alvarez Cabral, visited the land and took possession of

WHY BRAZIL HAS FEW RAILROADS

To reach the interior from almost any point on the coast, Brazilian railway lines must climb or pierce rugged ranges like the Serra do Mar shown here.



it in the name of his sovereign. Colonial rule in Brazil, as throughout the New World, was ruthless. First the Indians were enslaved, then Negroes were imported from Africa to labor long hours in the blazing fields. Unlike other Latin American colonies, Brazil's agricultural resources were well exploited, since its rich mines were not discovered until the end of the 17th century.

Brazil entered on the road toward independence in 1808, when the Portuguese royal family took refuge there to escape the advancing armies of Napoleon. When King John returned to Portugal, his eldest son, Dom Pedro, was left as prince regent. Inspired by the success of revolutionary movements in the Spanish colonies, the Brazilians in 1822 declared their independence, with Dom Pedro as emperor. Under the benevolent despotism of Dom Pedro II, who ruled for almost half a century (1840-89), slavery was abolished, trade was vastly expanded, and the population steadily grew. Nevertheless, after 1870 republican sentiment began to spread. In 1889 the empire was overthrown by a bloodless revolt and Dom Pedro was exiled in Europe. In 1891 a constitution closely modeled on that of the United States was adopted.

In the World War of 1914-1918, Brazil was the only South American nation to declare war on the Central Powers. The world depression of 1929 cut deep into Brazil's export trade and sharpened the long-standing political crisis. In 1930 Dr. Getulio Vargas seized the presidency by a swift armed revolt and made himself virtual dictator. He proclaimed a new constitution in 1937, setting up a parliament composed of a chamber of deputies and a federal council, with a national economic council to govern the economic life of the nation. Though the new constitution resembled those in fascist countries, Vargas was careful not to antagonize the United States and other democracies. He banned political groups receiving support from abroad, and in 1938 put down a revolt of native fascists. After the outbreak of the second World War, Brazil took a leading part in planning for Pan American defense, and its ties with the United States grew closer. Then Axis attacks on Brazil's shipping aroused public indignation, and on Aug. 22, 1942, Brazil declared war on Germany and Italy (*see* World War, Second.)

(For further study, *see* Latin America; South America. *See also* Brazil in FACT-INDEX at the end of this volume.)

Our DAILY BREAD and HOW It Is MADE

BREAD AND BAKING. Of all the things we eat, bread is the most important to the largest number of people. That is because it contains the largest share of the food substances essential to health for the least amount of money, and because most people like it so well that they eat it at every meal.

Bread is an excellent source of energy. It also contains minerals and vitamins, which build and repair the body. Without bread, larger quantities of the more expensive foods, such as eggs, milk, and fruits, must be eaten to maintain health. With bread, even the poor man can afford an adequate diet.

Bread of Other Lands

All over the world, as you read these words, millions of people are making bread. Much of the bread of other lands looks very different from the wheaten loaves or rolls that we know best. In Mexico and other American countries to the south, women bake coarsely ground cornmeal into flat cakes called tortillas (*tôr-tē'yās*). In Brazil they make similar little cakes from flour made from the cassava or manioc plant. In Scotland many people still prefer oatcakes or barley bannocks, baked on a griddle, to the finest wheat bread. In China and Japan much of the bread is made from rice flour, and in India from millet. And in Germany, the Scandinavian countries, and Russia, the chief breadstuffs are rye and barley, which grow better than wheat in most parts of these cold northern countries.

In the distant days when men first began to grow grain, they must soon have learned that porridge tasted better and kept longer if it was dropped on a hot stone and baked. At any rate, we can trace the history of bread far back to before the Christian Era. In the Metropolitan Museum of Art in New York City is a basket of bread baked about 3,500 years ago. It was found in a tomb at Thebes, where it had been buried with Hat-Nufer and Ra-Mose, husband and

wife, to nourish their departed spirits. Even older than this is a piece of bread discovered in the remains of a village of Swiss lake dwellers, who lived about 4,000 years ago.

The Story Behind a Loaf of Bread

To most of us bread is just something that appears on the table at every meal. It means no more than a glass of water. A few cents buys a loaf that lasts the average family a day or more. But, if we start to trace that familiar loaf of bread

to the seed grain planted by the farmer, we find a long trail leading back through many processes and calling for the coöperation of many people. Grain must be grown, railways must transport the grain to the millers, and the millers must grind the flour. After the bread is baked, it must be hurried to the grocery store. And finally the grocer may deliver it to homes.

It has not always been so easy to get a loaf of bread. People used to have to grow their own grain,

GREAT BRICK OVEN OF SWEDISH PEASANT



On many farms in Sweden and Norway, baking day is a rare event. This Swedish woman is baking several months' supply of the rye and barley bread which is the great food staple in these northern lands.

mill their own flour, and bake their own bread. In the United States, bakery products did not begin to replace homemade breads until the turn of the 20th century. Even then most housewives did their own baking. People want their bread fresh, and until the motor age made fast delivery possible commercial bakeries could not supply farms, villages, and small towns with fresh wares. Today they make about 80 per cent of all the bread consumed in the United States.

All breads belong to one or the other of two principal kinds—*leavened* or *unleavened*. Leavened bread contains some substance which generates bubbles of carbon dioxide gas and causes the loaf to *rise* and become light and porous. Unleavened bread is dry and hard throughout. Water crackers, oatmeal biscuits and Swedish rye crisp are familiar examples of unleavened bread. Ordinary bread is leavened with yeast. Biscuits, muffins, cakes, and other pastries are leavened with baking powder or sour milk and soda. A few breads, such as beaten biscuits, are leavened by introducing air. (See Baking Powder; Yeast.)

Before it was discovered how to prepare yeast in concentrated form, part of the uncooked dough was saved from each baking to mix with the next. Between bakings, this dough was soured, or fermented, by the wild yeasts in the air. When it was mixed with the fresh dough, it caused the whole batch to ferment and rise. The ancient Egyptians were probably the first to discover this process, which is still used in parts of the world where other leavening agents cannot be obtained.

What Bread Is Made Of

Though bread is made from a long list of plants—including rye, barley, corn, oats, buckwheat, rice, millet and sorghum, potatoes, soybeans, peas, cassava, bananas, nuts, and even alfalfa—the best and finest bread is made from wheat. Not only do most people prefer the taste and color of wheat bread, but a lighter loaf can be made from wheat than from any other cereal because it has more gluten. This is a sticky elastic substance which holds the gas bubbles produced by the yeast or the baking powder. Bread made from flour with little gluten is heavy. (See also Wheat.)

White bread lacks certain food elements that are present in whole wheat or graham, but it is more popu-

lar. People generally prefer the color and flavor resulting from the removal of the bran and the germ (see Flour and Flour-Milling). White flour also makes lighter bread. Flour made from hard wheat makes lighter bread than soft wheat flour, because it is richer in gluten. In the United States, rye and whole wheat breads are usually made lighter by the addition of a considerable amount of white flour.

In addition to flour, bread contains liquid, shortening, sweetening, and salt. Milk improves the flavor, appearance, nutritive value, and keeping qualities of the bread. Most commercial bakers use milk in the form of dry milk solids, which are both cheap and easy to mix with the other ingredients. Shortening is usually lard, cottonseed oil, or other vegetable oil. It makes the bread soft and tender. Sweetening may be cane, beet, or corn sugar, or a combination of the three. It makes the crust brown, assists fermentation, and adds flavor.

Other ingredients used by commercial bakers are *dough conditioners* and *yeast foods*.

The commonest of these are malt and phosphates or sulphates of ammonium or calcium. They hasten the action of the yeast and aid in making the product uniform in texture and structure.

Self-rising Flour and Prepared Mixes

The first step in baking with baking powder is to mix it with the flour. Hence it was natural that someone should conceive the idea of saving the cook's time by marketing a flour with which the ingredients of baking powder had been already mixed. This flour is called *self-rising flour*. It is usually made with a soft wheat base, and can be used in making any baked goods except yeast breads. Since the people of the South prefer hot biscuits and other quick breads, this kind of flour is a staple in most Southern kitchens.

Other time-savers are *prepared mixes*. They contain all the ingredients except the liquid. There are mixes for making pancakes, biscuits, pie crust, doughnuts, cakes, and other baked products. Some *prepared doughs*, such as biscuit doughs, are all ready to be put in the oven.

How Bread Is Made in the Large City Bakery

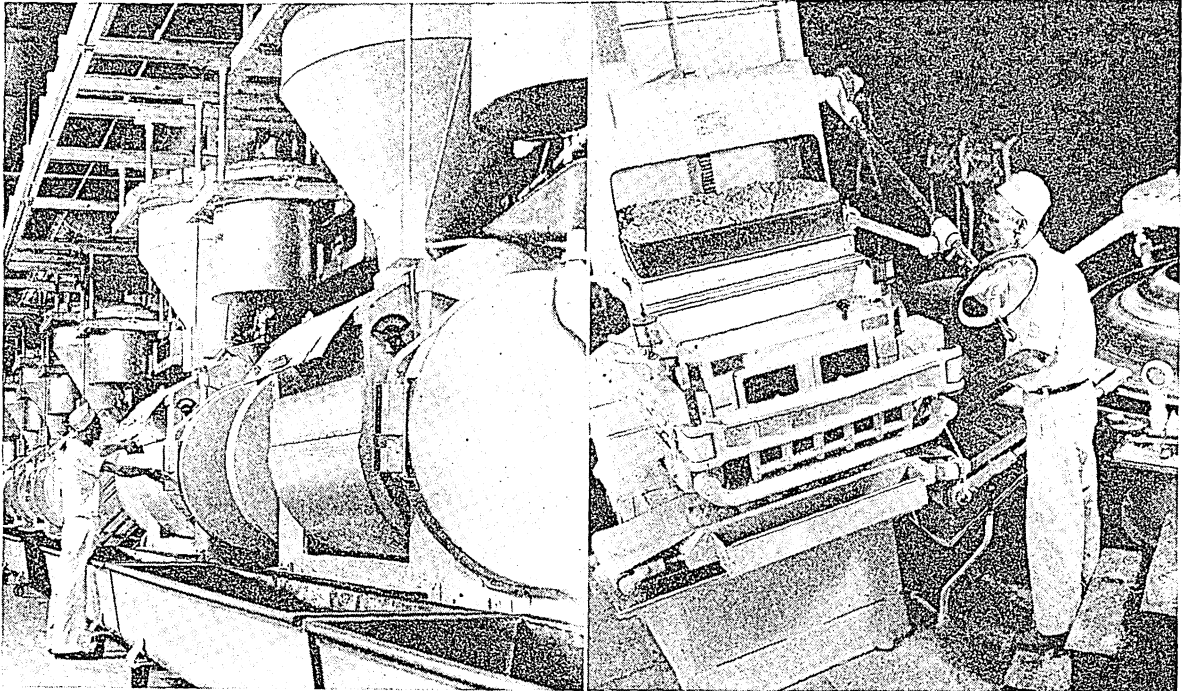
In the bakery of today, machines operated by skilled bakers do the work automatically. Nothing is left to chance. Ingredients are accurately weighed out. The temperature and humidity during the different

AN OUTDOOR OVEN IN QUEBEC



Outdoor ovens like this one, which is still in use on a Quebec farm, were once common in many parts of the United States and Canada. A fire is built on the oven floor, and when the temperature is right for baking, the ashes are raked out and the loaves are put in.

IN A MODERN BAKERY—MIXING AND DIVIDING THE DOUGH



1. The first step in making bread is the mixing. Flour from the floor above is automatically weighed through giant funnels into these great mixers. Here revolving metal arms mix a thousand pounds of dough at once. The dough then flows into the troughs already lined up and is taken in them to the fermentation room.

2. After the dough has fermented, it passes through the divider. This machine cuts it into pieces just the right weight for one loaf of bread. At the top you see the dough waiting to be divided. As it is cut into separate pieces, these drop to the belt below and are carried to the rounder at the right.

processes are closely regulated, and each process is carefully timed.

Since the flour must be *aged*, or matured, bakers used to store it in circulating air ten weeks or longer. The air worked slowly on the flour, bleaching it and improving its baking qualities. But now chemical bleaching agents accomplish this instantaneously, and flour can be used the same day it is milled. Most bakers, however, still store the flour for a short time to condition it.

Each baker uses a special *blend* of flour, produced either by mixing the wheat before it is milled or by mixing the flour afterward. If the baker does his own blending, the flour is sent to the blending bins on one of the top floors. Here the different varieties are mixed together in the desired proportions.

In most bakeries the manufacturing process starts at the top, so that gravity can draw the flour or dough from one machine down to the next. After a final sifting, the flour feeds into a scale which automatically weighs the right amount out into the *mixers* on the floor below. Water and other ingredients are then added. When the dough is mixed, it flows into huge troughs (pronounced by bakers to rhyme with "dough"), some as long as 12 feet. In these it is taken to the *fermentation room*. Here it is left to rise for several hours, until it is light.

In the *sponge dough* process only part of the flour is mixed with the liquid and yeast at first. When this batter, or sponge, has fermented sufficiently, the

remaining ingredients are added and the dough is allowed to *rest*, or rise, for a short time. In the *straight dough* process all the ingredients are mixed at the same time.

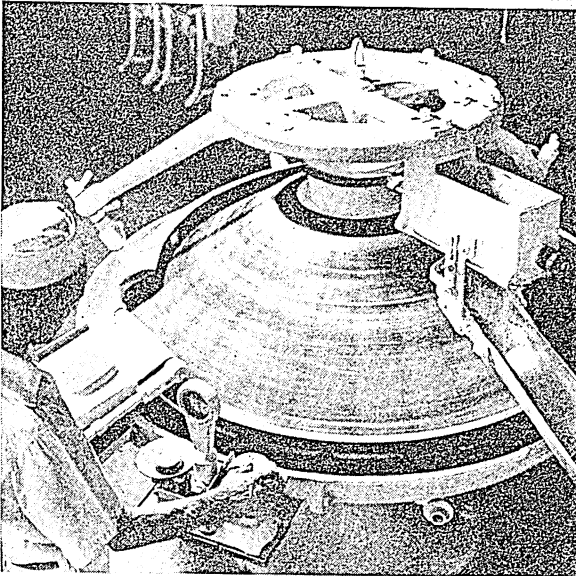
The *divider* then scales the dough into pieces of just the right weight for the pans. The *rounder* shapes the pieces into balls and drops them into buckets which move on a chain through the *overhead proofer*. Here the dough rests again for a few minutes while it recovers from rough handling in the divider and the rounder.

From the overhead proofer, the balls drop into the *molder*, where they are shaped to fit the pans. After the molded loaves are panned, they are placed on racks and rolled into the *proof box*. In this box they are given a final rise in slightly warmer, moister atmosphere than that of the fermentation room. They are then conveyed to the oven to bake at a steady temperature of more than 400° for about a half-hour.

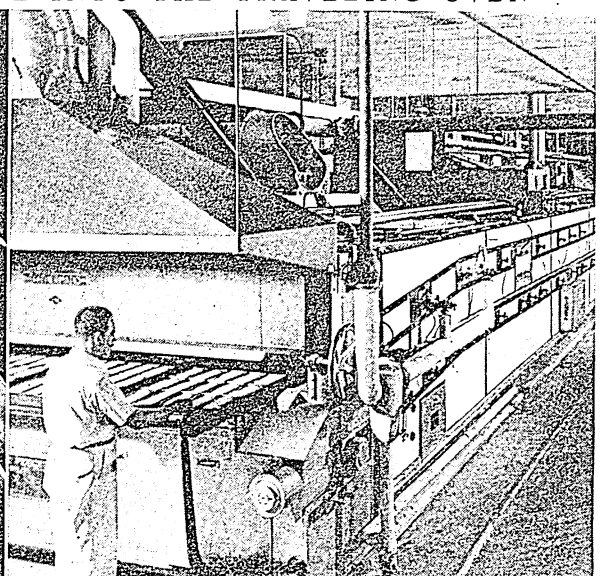
The most widely used ovens in large bakeries are reel ovens and traveling ovens. The reel oven resembles an enclosed Ferris wheel. In the traveling oven the pans move slowly on a conveyor through a long baking chamber, and the bread comes out baked at the far end. Some traveling ovens are more than 100 feet long and bake more than 5,000 loaves an hour. Low-pressure steam is injected into the oven to prevent the bread from crusting too quickly.

After the loaves have been gradually cooled, most of them are put through a *slicer* which cuts them into

FROM THE ROUNDING MACHINE INTO THE TRAVELING OVEN



3. This whirling cone-like machine is the rounder. It tumbles the pieces along a spiral track, shaping them into round balls and dusting them with flour before they slide to the overhead proofer. The operator is checking the weight of one of the balls.



4. The marvel of the modern bakery is the traveling oven. The operator is feeding the pans onto an endless hearth which carries them slowly through the long baking chamber. Through a door in the side of this chamber, the progress of the baking is checked.

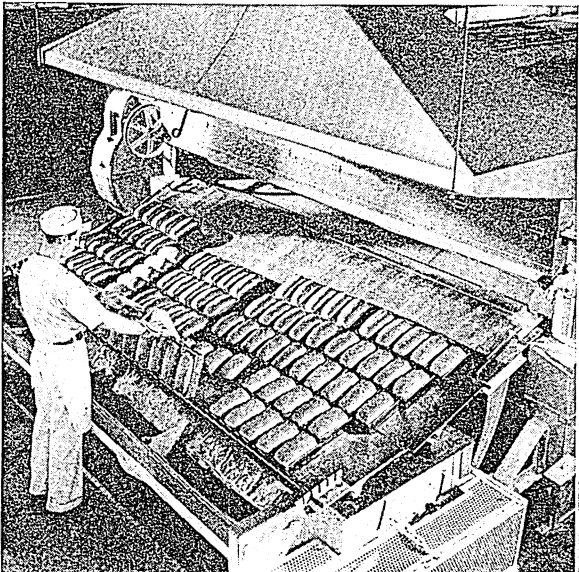
uniform slices. Finally the bread goes to the *wrapping machine*, where steel fingers cut printed moisture-proof paper from a roll, wrap it around each loaf, and fold it at the ends. The ends are then pressed against hot plates which seal the wrappers to keep the bread fresh and protect its flavor. Then in the early hours of the morning—for most bread is baked at night—the loaves are packed in trucks and carried swiftly to retailers near and far. The drivers of these

trucks are salesmen as well as drivers, for most of them get a commission on all the goods they sell.

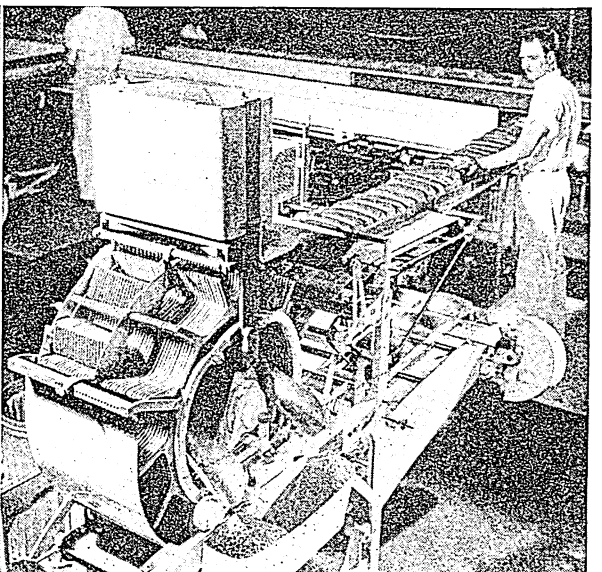
The Food Value of Bread

White bread and whole wheat bread rank about the same in most food values—low in proteins, high in carbohydrates, and negligible in fats. The greatest difference is in mineral and vitamin content. (See Food; Vitamins.) The milk in bread contributes considerable amounts of calcium and riboflavin (vitamin

BAKED AND SLICED, THE LOAVES ARE READY FOR WRAPPING



5. The loaves have completed their long slow journey through the traveling oven, and are sliding out at the end perfectly baked. An operator removes them from the pans and stacks them on racks (not shown). The racks are then rolled into the cooler.



6. After cooling, the loaves are ready for slicing. In this machine a series of razor-sharp knives cuts the loaf into uniform slices in such a way that it is not torn or squashed. A moving belt finally carries the sliced loaves to the wrapping machine.

B₂ or G). The wheat contains other important minerals and vitamins. These are chiefly in the bran and the germ. Most important are iron and the vitamins thiamin (B₁), riboflavin, and nicotinic acid (P-P). Thus many valuable food elements are lost when the bran and the germ are removed to make white flour.

Since many people do not get enough minerals and vitamins, the United States government has cooperated with millers and bakers in setting standards for "enriched" flour and bread to which minerals and synthetic vitamins are added. These standards require that a pound of this flour contain at least 1.66 milligrams of thiamin, 1.2 milligrams of riboflavin, 6 milligrams of nicotinic acid, and 6 milligrams of iron. The inclusion of certain amounts of vitamin D, calcium, and phosphorus is optional.

Flour may be enriched either by adding minerals and synthetic vitamins to white flour, or by so milling flour that the required amounts of the minerals and vitamins are saved, or by combining the two methods. Flour containing minerals and synthetic vitamins looks the same, tastes the same, and has the same baking and keeping qualities as ordinary flour. Flour produced by special milling is slightly darker.

Bread can be enriched by using enriched flour, by using high vitamin yeast, or by adding vitamin concentrates to the dough at the time of mixing. Six slices of this bread will supply from one-fourth to one-third of the daily requirements of these minerals and vitamins.

Other Bakery Products

Bread is only one of the many products the commercial baker offers. He also makes a variety of rolls, biscuits, cookies, crackers, cakes, pies, and other pastries. In making these, as in making bread, he follows special formulas and methods, and machines do much of the work. There are ingenious contrivances for molding and cutting them, for frosting and icing, for filling tubes of dough with pastes of various kinds, and for many other operations.

All cakes fall into two general classes—butter cakes and sponge cakes. Cakes that contain butter or some other fat are known as butter cakes. Those that contain no fat are called sponge cakes.

Butter cakes are made of fat, sugar, eggs, leavening, milk, flour, salt, and flavoring. Many varieties may be made by adding such things as chocolate, molasses, spices, nuts, and coconut.

Sponge cakes are made of eggs, sugar, flour, salt, and flavoring. Eggs furnish the liquid and also the air for leavening. Cream of tartar is added to make cake light and tender by making the walls of the air bubbles firm. Angel food and sunshine cakes are sponge cakes. Only the whites of eggs are used in angel food; in sunshine cake, both the yolks and whites are used.

Crackers and How They Are Made

Since its beginning little more than a century ago, the cracker industry in the United States has grown to be one of the largest branches of the baking in-

dustry. The first crackers were large, round, unsweetened, unleavened cakes, baked until they were very hard. They were somewhat like a water cracker. Because they kept better than ordinary bread and were more compact, they were in great demand for ship supplies and were called "pilot bread" or "ship bread." They were made entirely by hand, but, during the California gold rush, demand for this convenient food became so great that machinery was invented to roll the dough and stamp it into cakes. During the Civil War, the Army and Navy asked for such quantities of this "hardtack," as it was called, that an improved oven was invented. This invention increased the capacity of the bakeries several times. The familiar "soda cracker" and the soft "butter cracker" had also come into use by the time of the Civil War. These are made from raised dough and are lighter and more palatable than the hard cracker.

In England all crackers and biscuits, whether sweetened or unsweetened, soft or hard, plain or fancy, are called "biscuits." In the United States the term "biscuit" is applied to various forms of small sweetened and fancy cakes. The word "cracker" usually means a very thin, raised bread baked until it is dry, crisp, and brittle.

In making crackers as in making bread, most of the work is done mechanically. After the dough has fermented properly it goes to the *roller* which flattens it out into a sheet. The *cutter* then perforates it in the desired pattern. If salt crackers are being made, the sheet is sprinkled with salt. Finally it is carried to the oven on broad, long-handled paddles, called *peels*. The oven is usually a reel oven. When the crackers have baked thoroughly, they are cooled, wrapped, and boxed—ready for the consumer.

How the Consumer Is Protected

Since most consumers know very little about the bread they buy, laws have been passed for their protection. A large loaf, for instance, may not be a heavy loaf; it may contain more air and not more weight than another. Consequently some states require that only loaves of certain weights be sold and that wrappers be labeled accordingly. The Food and Drug Administration recommendations limit the proportions of moisture and starch other than wheat flour that a loaf may contain. They also specify that only whole wheat flour be used in making whole wheat, or graham, bread. Both state laws and the food and drug act prohibit deceptive trade names. Other consumer protections are labels telling the date of baking and listing the amounts of the ingredients used.

Without these aids, consumers can judge the quality of a bread by noting some of its characteristics. Good white bread is creamy white, with a satiny sheen and no streaks. It is elastic in texture and fine-grained with no large holes. Its shape is symmetrical, its crust is evenly browned, and its flavor has no suggestion of yeast, sourness, or mustiness. Whole-wheat bread is slightly smaller for the same weight and should have a whole-grain flavor.

BREADFRUIT. The large globular fruit of this tree furnishes the chief food of the South Pacific islands. On various species of the tree the fruit ripens at different periods of the year, thus affording an almost constant supply. The breadfruit tree—of which there are 40 species found throughout the tropical regions of both hemispheres—grows from 40 to 60 feet high, and is often limbless for half this height, with large spreading upper branches. The starchy fruit hanging from short thick stems is about the size of a child's head. It is first green, then brown, and when ripe turns yellow.

The breadfruit is prepared for use in a number of ways. The natives of the South Sea Islands usually gather it just before it is ripe and bake it entire in hot embers. They then scoop out the inside, which when properly cooked is soft and smooth with a taste not unlike boiled potatoes and sweet milk. Another method consists in cutting it into thin slices which are dried in the sun and then baked or made into a flour which is used in preparing puddings, bread, and biscuit. The fruit is kept by storing it in pits where it ferments and becomes sour, but after baking under hot stones, it yields a pleasant food. One author says of it: "With meat and gravy it is a vegetable superior to anything I know either in temperate or tropical countries. With sugar, milk, butter, or treacle it is a delicious pudding, having a very slight and delicate but characteristic flavor, which one never gets tired of."

From the fibrous inner bark of the tree a cloth is made, and from the wood, canoes and furniture. The sticky milky juice which exudes from cuts in the stem is used in making a kind of glue.

The breadfruit tree belongs to the *Moraceae* family, which also produces the osage orange. A somewhat similar, though inferior, fruit is produced by the Jack (*Artocarpus integrifolia*) growing in India, Ceylon, and the Eastern Archipelago. It is much eaten by natives in India.

BREAKFAST CEREALS. The modern breakfast cereals, whether brown and crisp and ready to serve from the package, or meant to be cooked into a delicious steaming hot dish, make the first meal of

the day quite different from the usual breakfast of only a few years ago. Then oatmeal porridge, cornmeal mush, boiled cracked wheat, or perhaps the old English dish "frumenty," made by boiling wheat kernels with milk and spices, were practically the only "cereal" foods used. The modern breakfast

foods, by making breakfast a simple, light, and wholesome meal, have done much to improve the diet of all civilized countries, especially for children.

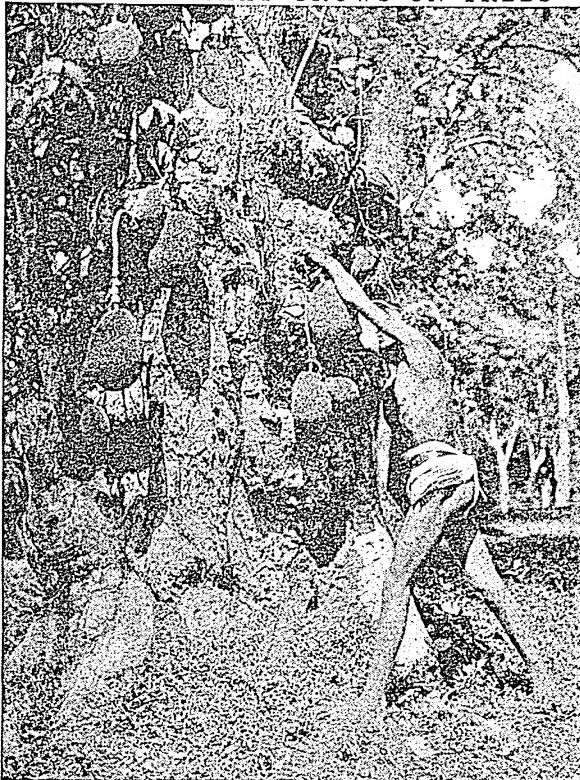
This great change in the breakfast menu has developed an enormous industry. Every year new forms of breakfast cereals, cooked or uncooked, are placed on the market. We have breakfast foods flaked, malted, shredded, ground, cracked, rolled, and puffed. The Department of Agriculture of the United States tells us how they are prepared:

"The ready-to-eat brands are prepared in a great variety of ways. Some are probably simply cooked in water and then dried and crushed. Some are made of a different mixture of grains, some have common salt, malt, and apparently sugar, molasses, or other carbohydrate material added

to them, some probably contain caramel or other similar coloring matter. Those with a flaky appearance are made like rolled grains, save that the cooking is continued longer. Those which look like dried crumbs are probably made into a dough, baked, crushed, and browned. The shredded preparations are made with special machinery which tears the steam-cooked kernels into shreds and deposits them into layers or bundles. Very many of the ready-to-eat cereals are parched or toasted before packing. This gives them a darker color, makes them more crisp, and imparts a flavor which many persons relish."

The puffed grains are most ingeniously made. Kernels of the grains are thoroughly cleaned, then they are placed in a gun-like cylinder and cooked with live steam. When the kernels have become thoroughly saturated with this exceedingly hot steam, they are shot from the cylinder into very cold air. Puff—the heat within the kernels bursts the cells and swells the grains to several times their natural size—

"BREAD" THAT GROWS ON TREES



Wouldn't it be wonderful if you could step out in your backyard, like this happy savage, and pick a dinner whenever you were hungry! Breadfruit may be baked and eaten fresh, or pounded to a pulp and allowed to ferment, forming a sour paste much relished by the Pacific islanders.

"shot from guns," in the familiar words of the advertising slogan invented by some ingenious writer.

Processing the Morning Meal

The first cereal breakfast food was probably made from oats, and that grain is still used more than any other. Let us follow the modern process by which it is changed to the familiar "rolled oats."

First the oats are cleaned and the ends snipped off. Next comes roasting, the most important part, for this releases the oil in the tiny cells to flavor the whole grain. Roasting is done in a kiln drier, where hot air from below blows the grains about in the air; or in a machine similar to a coffee roaster; or sometimes simply in open pans over a fire. After roasting, the oats are passed through rollers which slip off the hulls. Softened by steaming, the grains, or "groats," as they are now called, pass between big polished steam rollers that flatten them into flakes. Then they are poured into boxes, sealed by machinery, and dried in sufficient heat to kill any lurking germs.

Breakfast cereals are rich in carbohydrates (chiefly starch) and proteins. Those made from whole grains contain minerals, especially phosphorus, calcium, iron, copper, and manganese. They also contain vitamin B₁ (*thiamin*), which prevents beri-beri and other nervous disorders. The vitamin content of some prepared cereals is further enriched by the addition of thiamin, and by ultra-violet irradiation to supply vitamin D, which prevents rickets.

BREMEN (*brä'mēn*), GERMANY. The oldest maritime city in Germany, Bremen is still second only to Hamburg among German ports. From the North Sea ships travel 46 miles up the Weser River to Bremen's spacious modern harbors. There they unload cargoes of cotton, grain, coal, coffee, tobacco, wool, iron ore, chemicals, and jute. The empty freighters are in turn loaded with the products of Bremen's mills, breweries, factories, shipyards, foundries, and machine shops. Goods made here and in other cities of northwest Germany are brought by train to the docks. The twin city of Bremerhaven, near the mouth of the Weser to the northwest, serves as the port for vessels too large to be docked at Bremen.

Despite all the changes that modern life has brought, the people of Bremen cling to the traditions of their ancestors—those sturdy burghers and daring seamen who made this city one of the proudest and most independent in Germany. The city consists of two sections—the old town, on the Weser's north bank, and the new town, on the south bank. Much of the old town preserves the appearance of the Middle Ages, except that the ramparts which once encircled the city have been replaced by public gardens. In Market Square stands the old Town Hall. It has been guarded for more than 500 years by the statue of Roland, the emblem of civic liberty, who holds aloft the sword of justice. In the depths of the Town Hall is a famous wine cellar where vintages centuries old are stored. Adjoining—so directly that the wine cellar tunnels under it—is the Cathedral of St. Peter, built in the 11th

century. Alongside these medieval structures stand modern buildings, such as the new Town Hall, the Cotton Exchange, and the Museum. Several bridges spanning the Weser connect the old town with the new, much of which was rebuilt with wide streets and fine modern buildings.

Along with its sister seaports Hamburg and Lübeck, Bremen in the Middle Ages was a powerful member of the Hanseatic League (*see* Hanseatic League). Even after the decline of the league, these three remained "free cities," with local self-government, and each was the capital of a small state. After the creation of the German Empire in 1871, they lost most of their ancient privileges. The last vestige of these privileges disappeared in 1935 when Bremen, with all German cities, was brought under the direct rule of the national government. The state of Bremen also lost the authority it formerly held over its territory of 99 square miles. During the second World War, the city of Bremen suffered severe damage from British air raids. Population, about 345,000.

BREST, FRANCE. Near the tip of the rugged coast of Brittany, in northwestern France, lies the seaport of Brest. It is not large, but its strategic position as a port and naval base adjoining the English Channel has given it a rôle in history. During the 17th and 18th centuries several sea battles between France and England were fought here. In the World War of 1914–1918, it was a principal port for the American Expeditionary Force. During the second World War, it was occupied by Germany. It was bombed repeatedly by the British air force, with great damage to the harbor.

Ships enter the wide rock-bound harbor through a narrow strait guarded by a formidable system of modern forts. The harbor, first developed by Richelieu in the 17th century, was later improved by Colbert and fortified by Vauban. The city is a port of call for some transatlantic liners and is the terminus of a submarine cable to America.

The city is built on the steep slopes of two hills, separated by the Penfeld River. A grim old castle, built in the 12th century and later reconstructed, stands guard at the river's mouth. Between the town and the harbor, the Cours d'Ajot, one of the finest promenades in Europe, skirts the shore.

Important sardine and mackerel fisheries are located in Brest, as well as large flour mills, chemical plants, shipyards, and munitions factories. The leading imports generally include wheat, wine, coal, petroleum, and iron and steel. Population, about 80,000.

BREWSTER, WILLIAM (1567–1644). As a student at Cambridge, William Brewster first came in contact with the Puritan ideas which made him one of the leaders of the Pilgrim Fathers. While in the service of William Davison, ambassador to Holland, he made several trips to Holland. Later, Brewster returned to his home village of Scrooby to take over the office of "post." His duties involved sending mail, keeping the inn, and supplying horses for the

post roads. He and his wife Mary had five children, Jonathan, Love, Wrestling, Patience, and Fear.

Earnest men and women, who had formed a Separatist church at Scrooby, gathered secretly for devotions in the Brewster manor-house. They wanted to worship in their own way instead of conforming to the Church of England. Brewster, who was an "elder" in the congregation, and several others were imprisoned before all fled to Holland in 1608. At Leyden, the scholarly Brewster supported his family by teaching English and printing religious books outlawed in England. He helped obtain a patent from the London Company for land in Virginia, but chance brought him with his 102 exiles to Cape Cod instead (see 'Mayflower'; Plymouth). During that first winter of 1620-21 which wiped out nearly half the colonists, Brewster was one of the seven strong enough to care for the sick and bury the dead.

BRIAND, ARISTIDE (*brē-ān' ā-rēs'tēd*) (1862-1932).

If you had dropped into a certain French country inn one September day in 1926, you would have seen two men lingering over their coffee, talking like old friends. These men, you are amazed to learn, are the French and German foreign ministers. The stooped, untidy looking one with shaggy gray hair and drooping mustache is the French minister, Aristide Briand, who has arranged the little party.

The luncheon is typical of Briand's diplomacy. Back in Paris, politicians are bickering. Across the border, statesmen are worried. Briand remains calm but impatient with the stilted methods of statecraft. He is a fascinating talker. When a tense moment arrives, he relieves it by telling an amusing story. Sometimes his light blue eyes are lazily half shut. Sometimes they sparkle brightly with wit and irony. There is something profoundly tranquil about this man, you observe, and something cynical. He looks as if he has met with everything in his experience, believes anything possible, but thinks only a very few things important. Late into the afternoon these two men talk, and when they finally go off, arm in arm together, the way has been paved for an agreement in which France and Germany both make wide concessions in the interest of peace.

Briand was born at Nantes in western France on March 28, 1862. He was educated for law, but preferred journalism. He wrote political articles for radical publications, and with Jean Jaures founded the newspaper *l'Humanité*. He became a leader of the

French Socialist party, and in 1902 was elected to the Chamber of Deputies. Supremely sane, he could perceive instantly the essentials of a question, stripped of details, and could present any problem simply.

As chairman of a committee to draft a law for separation of church and state, he issued a report that became the basis of the separation law. In 1906, he was appointed minister of public instruction and worship. After the Socialist party expelled him for accepting a portfolio in a conservative ministry, he drew his support from the more conservative groups. He became minister of justice in 1908, and in 1909, premier—a position he was to hold more often than any other man in French history. His government fell in 1910, and another in 1911. He was minister of justice in 1912, premier for a month in 1913, became minister of justice again in 1914; and from October 1915 to March 1917, during the World War, he held the difficult double post of premier and minister of

foreign affairs with but one interruption.

He assumed his previous double post in 1921, and bent every effort to bring France and Germany into harmony.

At the 1921 naval disarmament conference in Washington foreigners thought he presented the French demands very ably, but at home the Nationalists denounced him for not being firmer with reparations and enforcement of the Versailles treaty. England warned against a too harsh policy, and Briand, seeing also the dangers of severity, tried to reconcile French and British views; but his enemies forced him to resign just at the close of the allied conference

at Cannes in 1922. In 1925 he was minister of foreign affairs again, and that year saw the fulfillment of one of his dreams when a series of peace and arbitration pacts was signed at Locarno by Germany and her former European enemies.

Soon thereafter, French finances reached a deplorable state, and ministries rose and fell. From Nov. 28, 1925, to July 17, 1926, M. Briand formed three different cabinets. He was premier again in 1929. During all this time, except three days in 1926, he was minister of foreign affairs.

He was defeated for the presidency in 1931 because of dissatisfaction with his foreign policy. He shared the Nobel peace prize of 1926, was co-author of the Kellogg-Briand Peace Pact renouncing war as an instrument of national policy, and was the author of a plan for a United States of Europe.

PEACEMAKER OF FRANCE



A rare combination of true patriotism and a sane love for peace led Aristide Briand to adopt from the beginning of his political career a policy of moderation and tolerance toward his own and his nation's enemies.

The MAKING and the LAYING of BRICK and TILE

BRICK AND TILE. The story of bricks carries us back to the dawn of civilization, for almost as soon as men began to erect temples and palaces, they learned that a cheap and durable building material could be obtained by molding clay into rectangular "mud pies" and allowing them to harden, either in the sun or in artificial heat. Kiln-burned bricks made by the Babylonians 6,000 years ago still exist, and the entire site once occupied by the vanished city of Babylon is little more than a huge mound made by the breaking down and dissolving of the former huts and houses of sun-baked brick.

The ancient Egyptians had an inexhaustible supply of brick-making material in the clay which forms the bed of the river Nile, and brick making was always

one of their chief industries. Because this clay lacked tenacity, the Egyptians used to add chopped straw or reeds, which served to bind the bricks together. You remember how the children of Israel during the mournful years of their bondage in Egypt were set at making bricks, and how the cruel taskmasters added to their woes by requiring them to make "bricks without straw"; that is, ordered them to furnish their own straw without diminishing

the quantity of bricks produced in a given time. The Egyptian bricks were nearly all sun-dried, not kiln-burned, like the *adobe* bricks of Mexico and the southwestern part of the United States. Adobe bricks can be used where there is no frost to freeze the moisture in them and crack them.

An Important Modern Industry

Today brick making is one of the world's great industries. Nearly every community of any size has its own brick plant, unless it has an abundant and cheap supply of other building materials close at hand. The industry is widely scattered because bricks can be made of almost any kind of clay, mixed with sand. Brick clay consists largely of hydrated silicates of aluminum, with oxide or carbonate of iron, and various other substances. When they are burned, bricks of this composition have a buff, salmon, or red color, due to the presence of the iron. If much

carbonate of lime or chalk is present, the color is sulphur-yellow. If sand is not already present in the clay, it must be added. If there is too much sand the bricks are likely to crumble, and if there is too little the bricks will easily crack.

Preparing the Clay

Clay for bricks is dug by steam or electric shovels, crushed by hammer devices or rollers, and sifted to remove rocks or other bulky material. Then the screened clay, sometimes with anthracite coal dust added to promote burning, is mixed with water and kneaded thoroughly by great revolving knives in a "pug-mill." Modern practise uses one of three machine systems—the soft-mud, the stiff-mud, or the dry-clay machine. The stiff-mud process is most commonly

used in the United States. As the clay is forced out in columns it is cut by wires, 18 bricks at a time. Some machines turn out 300,000 bricks a day.

Workmen then pile them on cars, perhaps 1,000 on each, which carry them through tunnel driers that remove nearly a pound of moisture from each brick in 24 hours. The tunnels are heated by exhaust from the kilns, and the air is kept dry by ventilation. If the air should get too

damp, moisture from the interior of the brick comes to the surface, carrying with it the soluble salts of the clay, which cause the white seum seen on poorly dried bricks.

In the soft-mud process, machinery presses the mixed clay in molds, and the brick is not as hard or durable as the stiff-mud brick.

For the expensive dry-pressed brick, clay almost dry is pressed in steel molds. This type is used for artistic front-wall finishes, or decorative interior work. Sometimes brick is dried in the open air, or on steam-heated floors.

Strengthening the Brick by Fire

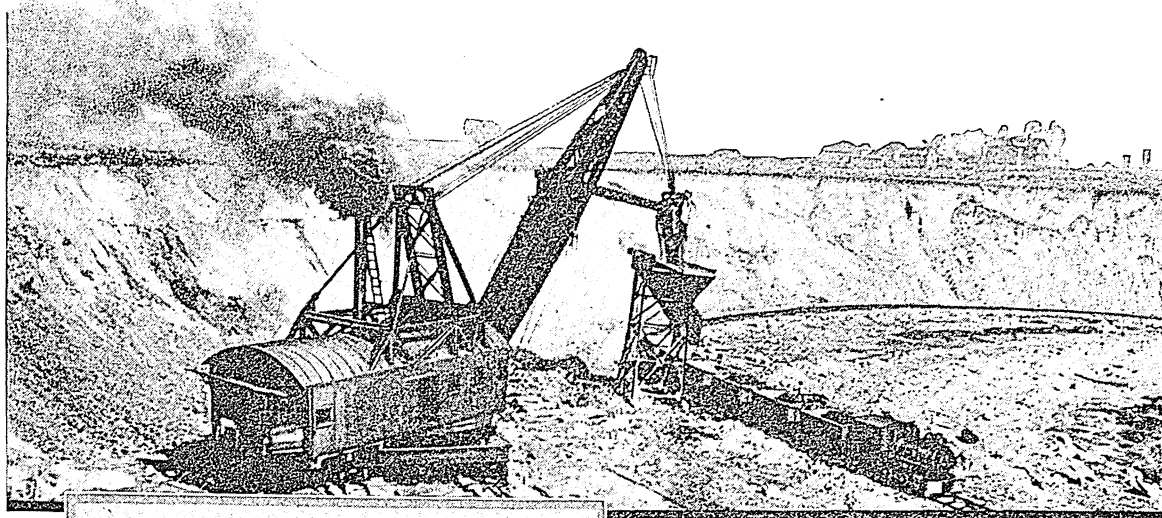
The next step is the all-important burning, in which the chemical properties of the clay are changed to give it strength and durability. In the continuous car kiln, the brick passes on fire-proof cars through tunnels 300 or 400 feet long, from a preheating zone

PLYING A TRADE THAT IS CENTURIES OLD

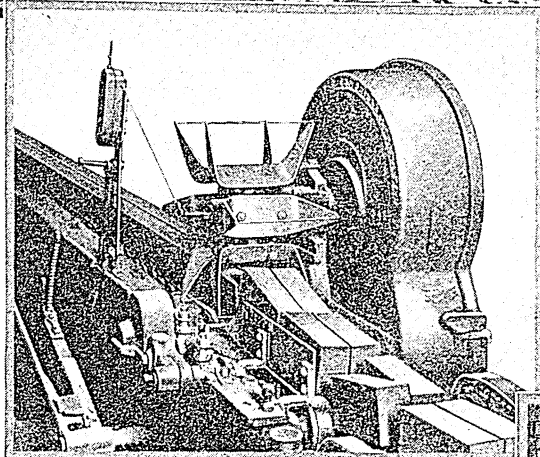


These brickmakers near the ancient city of Nineveh still mix clay from the bed of the Tigris with weeds for a binder, and set the molded bricks out in the hot Mesopotamian sun to dry, just as was done in the days when Nineveh and Babylon were flourishing cities.

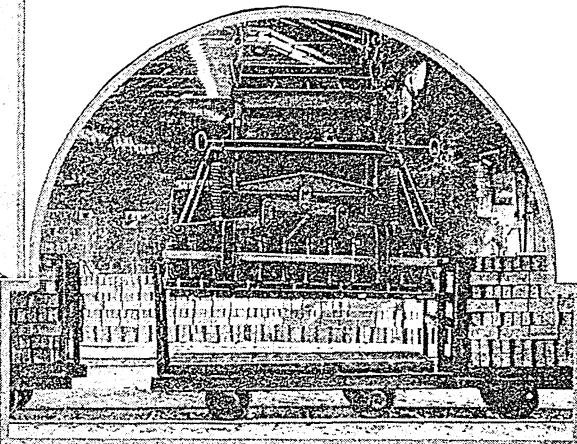
STEPS IN THE PRODUCTION OF A BRICK



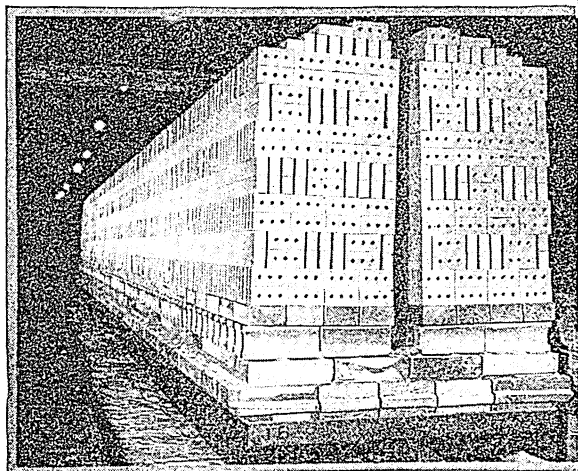
Great power shovels dig clay from pits in huge bites, and dump it into the hoppers over narrow-gauge cars, as pictured above. Sometimes the clay contains the exact mixture of sand and other ingredients needed for bricks.



A pug-mill, much like a sausage grinder, chops and mixes the clay with water, and the mixture is forced through the square mold on the brick machine seen above. Wires on the revolving fixture cut the mud to brick size.

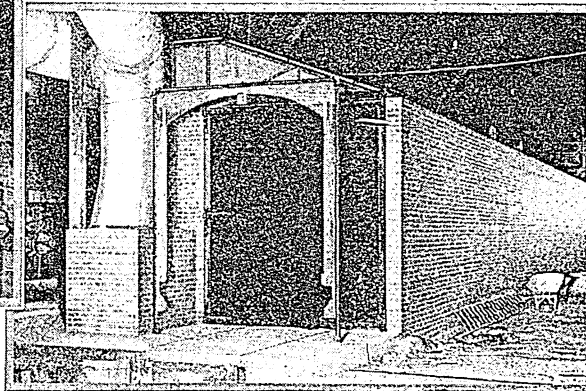


Newly made bricks are stacked on drier cars by the setting machine shown above. These "setters," operated by overhead electric cranes, lift and stack 1,000 bricks in one minute, leaving an air space around each.

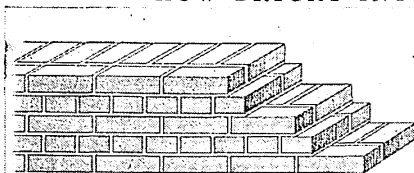


Here comes a load of hollow bricks on its way to the kiln. The first part of a tunnel kiln is a preheating or drying zone where excess moisture is removed from the bricks so that soluble salts cannot cause discoloration.

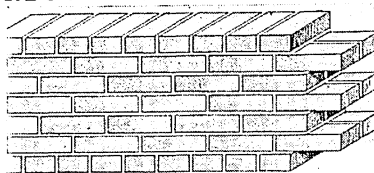
After passing the preheating zone of the kiln below, the bricks enter the burning zone. Here the combustible matter is burned out, after which the bricks pass into the cooling chamber. After cooling they are ready for use.



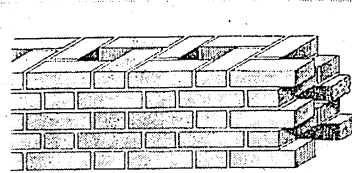
HOW BRICKS INTERLOCK TO FORM STRONG SOLID WALLS



ENGLISH BOND



COMMON OR AMERICAN BOND



FLEMISH BOND

Of the many patterns or "bonds" used by bricklayers, these three are the most favored. The English bond consists of alternate courses of lengthwise bricks (stretchers) and crosswise bricks (headers). A course faced with stretchers is backed, as you can see, with headers, and vice versa. This interlocks the front and back of the wall. In the American, or common bond, five or six courses of stretchers are laid front and back, then a course of headers across the thickness of the wall. Flemish bond is made with alternate headers and stretchers in each course, staggered front and back to form hollow squares.

to the furnace or burning zone, then to a cooling zone. For common brick, the temperature of the furnace runs to about 2,100° F. Coal, oil, or gas are the usual furnace fuels.

In the circular or oval kiln, fire passes up through the walls to the arched roof and is shot down upon all parts of the bricks. Sometimes, especially in Europe, bricks are piled to form their own kiln. As many as 3,000,000 bricks may be burned in one such "clamp," and it is kept burning from two to six weeks.

Machines Do the Work

In modern plants, bricks are piled by hand only once, when they come from the brick machine, and are stacked on cars to go through the drier. Mechanical "setters," with finger-like projections, which fit in spaces between the bricks in the two lowest rows, lift 1,000 bricks at a time to build kilns of 1,000,000 or more bricks. These kilns are daubed with clay on the outside to retain the heat; oil burners at ground level blow in oil with a jet of steam. At first, the oil is ignited by "targets," or torches, just inside the wall; as the heat increases, the wall becomes hot enough to fire the oil, and the targets are withdrawn. The heat, rising in a V-shaped cloud, requires about 72 hours to reach the top. Experienced kiln men know by the color of the outside wall how the heat is rising, and seldom use gauges. A 1,000,000-brick kiln will cool in two days.

Bricks for Special Purposes

Facing, or face brick, for prominent parts of buildings, is re-pressed before being dried. This process squares the corners and edges and gives a smooth surface. Tapestry brick has a design pressed on the brick in the mold. Fire brick is made of clay with little or no fusible materials. Special high-refractory bricks, made to withstand the terrific temperatures and the sudden heating and cooling in certain manufacturing processes, contain zirconia, magnesia, chromite, or other minerals. The "high alumina brick" used for great temperatures is made chiefly from diaspore or from crystalline alumina. Glass manufacturers make a fine refractory (heat-resisting) brick by melting the materials in an electric furnace and pouring the liquid into molds. Lime is added to paving, or vitrified brick, for extra hardness.

Bricklaying Methods

The strength of brick masonry depends as much upon the manner in which the bricks are laid as it

does upon the quality of the bricks used. They must be interlocked or "bonded" so that they cling together stoutly. For this purpose bricks are usually made twice as long as they are wide, the common dimensions in America being 2 x 4 x 8. How these dimensions fit the methods of laying is readily seen by examining the patterns of the three most commonly used "bonds," illustrated on this page.

A brick laid lengthwise of a wall is called a "stretcher"; a crosswise brick is a "header"; and any horizontal row of bricks in a wall is a "course." Bonding, therefore, is simply an arrangement of stretchers and headers so planned that the front and back of a wall are linked by headers and that the stretchers or headers in each course overlap the joints in the course below.

A brick broken in half is called a "bat," and when used to fill out a course at a corner it is called a "closer." When bricks are set vertically, as in porch posts, for example, the stretchers are called "soldiers" and the headers "rowlocks."

Besides the English, Flemish, and common or American bonds illustrated here, many other arrangements have been worked out to produce pleasing variations of pattern. Certain lines in any pattern may be emphasized by laying them with bricks different in color from the others.

The mortar joints, which make up about one-seventh of the wall, are almost as important as the arrangement of the bricks, both for appearance and for the durability of the work. The color of the mortar should bring out the fine tones and shades of the brick. This color relation is also affected by the size of the joints, which range from thin "buttered" joints to joints an inch wide. Joints may be tooled into various shapes, raked out, or cut flush. For the best results bricks must be damp when laid in the mortar.

The Use of Face Brick

Face brick is popular for both exterior and interior work because it is made in a wide variety of surfaces and colors that lend themselves to decorative purposes. Face brick is used chiefly for the outer shell of a wall; behind it is usually a heavy supporting wall of common brick to supply the strength the face brick lacks. In such construction an air space is left between the two walls. This keeps out moisture, cold, and heat, and so serves to make buildings warmer in winter and cooler in summer.

Smooth or semi-smooth face brick of light bronze, golden buff, tan, reddish, or pearl tones is popular for houses. In kitchens and similar rooms, face brick coated with enamel or a salt glaze is often used. For fireplaces, rough or smooth-textured face brick may be chosen to suit the taste of the home builder. But face and common bricks are widely used for garden walls, arched gateways, walks, and driveways.

Brick-paved sidewalks, streets, and highways, once common, have largely given way to asphalt or concrete, which provides a smoother surface.

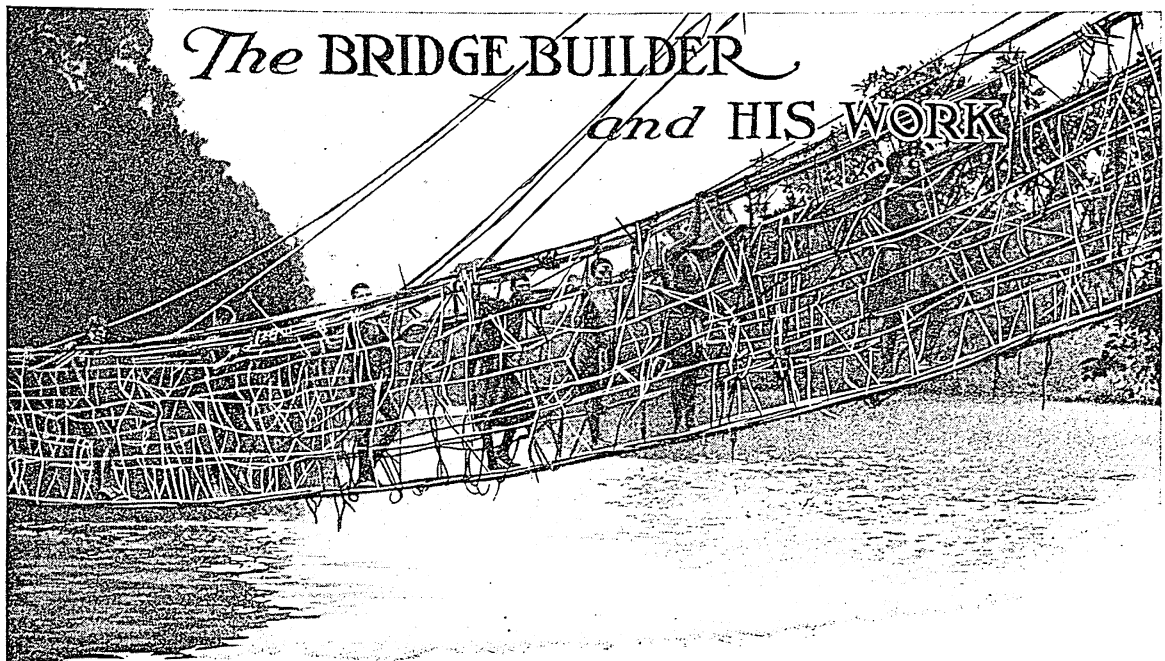
Clay Tile and Its Uses

Glazed earthenware drain tile, an important contribution to civilization, was invented by Sir Henry Doulton (1820-1897), an English potter. This tile made it possible, for the first time, to carry off sewage effectively. Previously, the best drains were

of brick, through which some seepage was certain to occur and pollute the soil. Such tile also made it possible to drain swamp lands.

Tile is made in much the same way as brick, in a variety of shapes and patterns. Pottery drain and sewer pipe (vitrified tile), unglazed or common drain tile, hollow tile for chimneys and fire-proof walls and partitions are made by machines that squeeze soft clay through openings of the desired size or shape, producing tubes or other forms, which are then cut into standard lengths, dried, and burned in a kiln.

Tiles for roofs, floors, walls, and decorative purposes are made of clay pressed into metal molds, fired, decorated, and glazed. Unglazed tiles, in patterns of different colors, are often used for floors. A fine decorative tile of especially pure clay, called *encaustic* (colored or painted) tile, is made for walls.



Our modern steel suspension bridges, wonderful as they are, are cousins of the crude native affair above, made of vines and creepers. Such bridges, found in many parts of the world, follow much the same principles used in modern engineering works.

BRIDGE. A tree trunk fallen across a stream, or a stout vine growing over a ravine served very well as a bridge for primitive man. Stones and timbers placed in the stream as props make it possible to build longer bridges, and tough vines woven together form rude hammock bridges suspended from bank to bank. A single strip of rawhide makes a native bridge in out-of-the-way India, and holding to a stick hooked over this cable the traveler is hauled across the stream by someone on the opposite bank. Man does not go far on the road to civilization before the pathway bridge becomes a highway bridge for horse, cart, and wagon; and finally the "iron horse" with its thousand-ton loads of freight and the streams of motor cars demand new and stronger bridges.

Few problems in the world are more challenging than those confronting an engineer when he starts to build a great bridge. First, how wide is the water or gorge to be crossed? What kinds of bridge can be built there at all? How much will each kind cost? If the cheapest kind calls for foundation piers in water, can a firm foundation be found, and will currents, tides, and storms permit building them?

Next the engineer must plan approaches. Often the cost of real estate in a city, compelling short approaches, determines the kind of bridge to be built. Construction time must be considered, when interest charges alone may amount to a million dollars a year.

Just as many questions arise in planning details. Samples of steel are tested in machines that pound

the samples with monstrous weights, and that bend, twist, and draw them out, to make sure that every part of the bridge will "stand up." One weak part could wreck a whole bridge. The planner must consider forces other than loads. Heat expands bridges; cold contracts them; unless correct allowances are made, one summer or winter day can reduce a bridge to scrap metal. Strong winds wrestle with the bridge, adding 50 or 60 pounds a square foot to its burden. Soldiers marching in step on a bridge might set it swinging.

Do You Like Adventure? This Is the Life for You

If you like adventure, consider the life of the bridge builder. You may have to battle storms and currents placing foundations in a river. A railroad may send you into a wilderness, making approaches. Or consider the men who build the bridge itself. They ride great beams swung up to lofty positions by puffing derricks; others climb about the framework and run out on beams far above the water, placing, riveting, hammering, until the whole structure hums like a busy beehive. Suspension bridge workers, like human spiders, must spin every single wire in the mighty cables singly across the river.

Every bridge gives engineers and builders some new problems to work out. Especially interesting are the movable bridges constructed so as to permit large ships to pass. Some, called bascule bridges, are divided in the middle and tilt up like the blades of a jack-knife. Of this type, the most famous example is the Tower Bridge at London. In others a central span turns on a pivot, or is lifted up the sides of towers. Such bridges are operated by electric machinery. The "pontoon" bridge, floating on boats, is built for temporary use, particularly by armies, and also as a permanent structure. There are bridges of this type over Lake Washington, at Seattle, and over the Golden Horn, at Istanbul (Constantinople). The Seattle bridge has a draw span and reinforced concrete pontoons. The Turkish bridge has steel pontoons and a movable center section. Here and there we still see picturesque covered wooden bridges built a century or so ago. Many medieval bridges were built with shops and houses on each side of the roadway, as in the still standing Ponte Vecchio of Florence and the London Bridge of nursery fame.

Roebling's Fight for Suspension Bridges

For spanning the greatest distances, the *suspension* bridge, with a roadway hung from huge cables swung between supporting piers, is champion. John A. Roebling spent a lifetime convincing people of this. They were doubly doubtful when eminent engineers said that his railroad suspension bridge, opened across the Niagara gorge in 1855, was "shaky." Later, when New York City and Brooklyn decided to have a bridge over the East River uniting them, Roebling persuaded them to let him try his suspension idea. Years passed, while foundations were sunk and wires were spun. In the meantime Roebling died; but his son finished the job in 1883, and Brooklyn Bridge stands today,

stoutly carrying trucks, automobiles, walkers, elevated trains, and street cars, in an endless stream.

Suspension bridges, however, are extremely costly. One reason is that strong foundation piers are needed. Another costly job is spinning the main cables. This is done by spinning wheels, which travel across the space on temporary cables, dragging lengths of wire behind them, until all the wire needed has been spun. The wires then are pressed and bound to form cables; suspender cables are hung from the main ones; and finally the roadway is hung from the suspender cables.

The Ingenious Cantilever Bridge

Next in spanning capacity is the *cantilever* bridge, which has a unit called a truss in the center, and units called cantilevers at the ends. The secret of this bridge is the action of the cantilevers.

As shown in the picture of the Quebec Bridge on page 241, each cantilever is a double-ended bracket, which rests at its center on a solid pier. Hence it tends to rock, seesaw fashion, when weight is applied at either end; for example, the weight of the truss tends to push down the inner end of each cantilever, and to tilt up the shore end. But the cantilevers cannot move because the shore ends are well anchored; and so the truss is held securely in place.

The great advantage of this plan is that, in general principle, each unit need only be strong enough to do its share, and the bridge costs much less than if it had a single unit strong enough to span the entire space. The same principle applies in the Carquinez Straits Bridge shown on page 243. This bridge has not only two end cantilevers, but also a center cantilever, which holds the inner ends of two trusses balanced against each other.

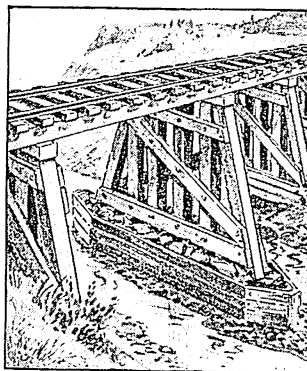
Arches, Trusses, and Girder Bridges

After the cantilever comes the *arch* bridge, with its ingenious way of gaining strength (*see Arch*). The Romans built stone arch bridges, but 50 feet was the limit of their spans. Today, steel makes huge spans possible. Arched bridges of reinforced concrete or masonry are often used for beauty, where cheaper types would do.

For short spans the simple *girder* bridge, with straight steel members, is commonly used. For somewhat longer spans a *truss* may be used. The members

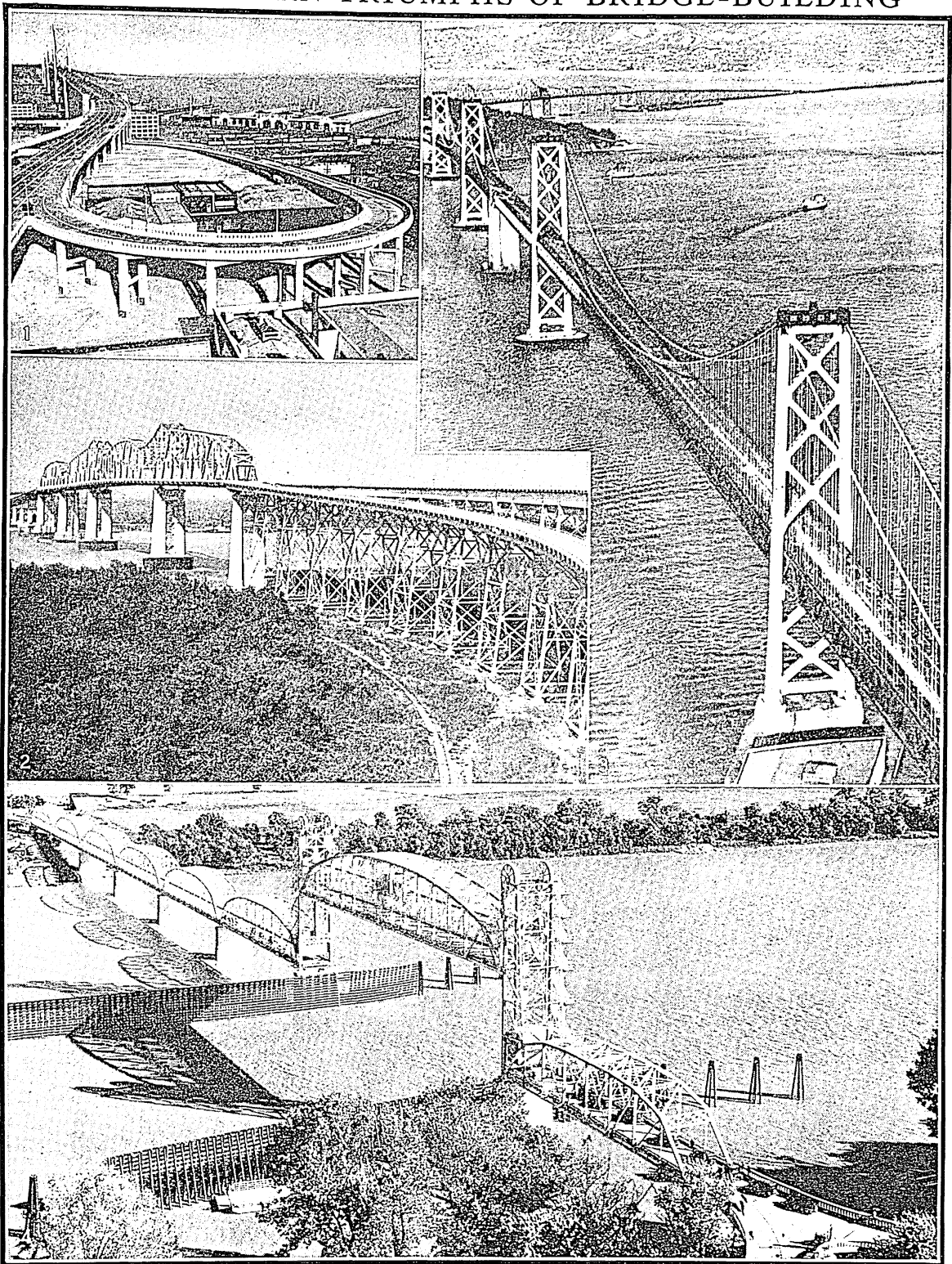
of a truss are arranged in triangles, because triangles can be altered in size or shape only by breaking the metal. Often the truss is arched top or bottom for added strength.

Triangles also are used to strengthen trestlework, made of timber. A *trestle* consists of several up-rights, with diagonal braces placed across



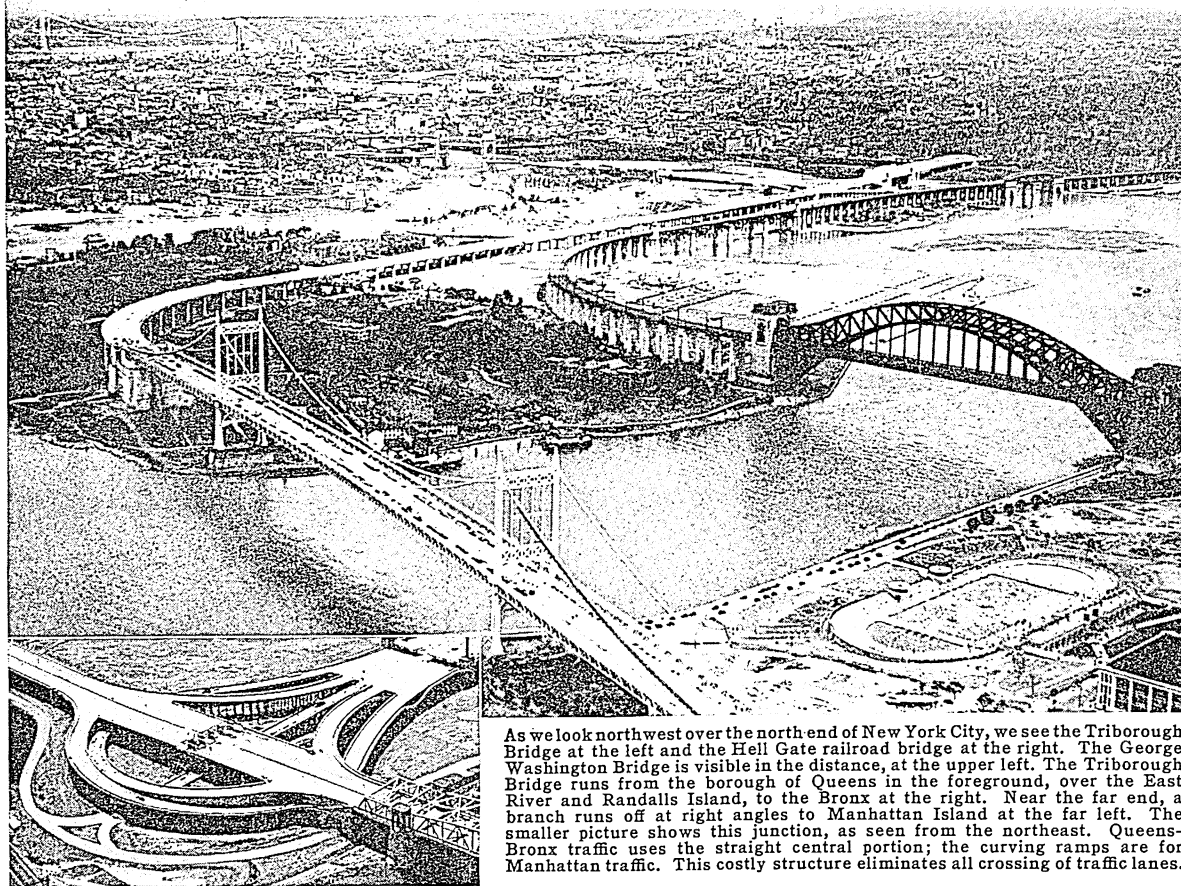
A Trestle Bridge

THREE MODERN TRIUMPHS OF BRIDGE-BUILDING



In the upper pictures we see the once supposedly "impossible" feat of bridging San Francisco Bay actually accomplished. The left-hand view (1) shows a winding approach in San Francisco to the San Francisco-Oakland Bay Bridge, which rises high above the waterfront and the shipping on mighty suspension spans (picture 3) and passes through Yerba Buena Island in a tunnel. A cantilever unit, trusses, and girder spans complete the connection with the east shore at a point between Berkeley and Oakland. The left-center picture (2) shows the Huey Long cantilever bridge across the Mississippi at New Orleans. The bottom picture (4) shows a vertical lift bridge over the Illinois River. The lift provides passage for towboats and barges using the Great-Lakes-to-Gulf Waterway; the screen-like structures keep the towed barges from bumping into the bridge, as they swing in the current.

THE HUGE TRIBOROUGH AND HELL GATE BRIDGES IN NEW YORK CITY



As we look northwest over the north end of New York City, we see the Triborough Bridge at the left and the Hell Gate railroad bridge at the right. The George Washington Bridge is visible in the distance, at the upper left. The Triborough Bridge runs from the borough of Queens in the foreground, over the East River and Randall's Island, to the Bronx at the right. Near the far end, a branch runs off at right angles to Manhattan Island at the far left. The smaller picture shows this junction, as seen from the northeast. Queens-Bronx traffic uses the straight central portion; the curving ramps are for Manhattan traffic. This costly structure eliminates all crossing of traffic lanes.

the uprights and at the sides to form strengthening triangles. This simple construction, which gives a low-cost bridge, made railroads possible in thinly-settled regions in the 19th century.

Noted Bridges of the World

The champion of all bridges for length of clear span is the Golden Gate Bridge at San Francisco. Started in 1932, this suspension bridge was opened to foot traffic May 27, 1937, and formally opened a day later. It has a span of 4,200 feet between the main towers, and it clears high water by a minimum of 220 feet, under full load and when the metal is at maximum expansion due to heat. Cold and lack of load can raise the roadway 10 feet in the center; and the piers sway 40 inches at the top as the main cables expand and contract. This bridge cost about \$35,000,000.

San Francisco also has the world's longest bridge, across San Francisco Bay to Oakland and Berkeley. This bridge, opened Nov. 12, 1936, is $8\frac{1}{4}$ miles long with approaches and has a main structure 22,720 feet long. It cost \$77,200,000. New York City has a still more expensive bridge—the Triborough Bridge shown above, which was opened July 11, 1936. The main structure cost \$60,300,000, and the approaches \$17,800,000.

The former champion suspension bridge, both for cost and length of clear span, was the George Washington Memorial Bridge between New York City and Fort Lee, N. J. The clear span is 3,500 feet, and it clears high water at the center by about 213 feet. It has four main cables, because it was designed for extremely heavy traffic, including street cars. Each cable is one yard thick, as are those of the Golden Gate Bridge, which has only two. On the New Jersey side, the

cables are cemented into solid rock for 250 feet; the New York ends are anchored in a concrete block 200 feet wide, 290 feet long, and 130 feet (the height of a 12-story building) high. This bridge cost \$60,000,000; it was opened in 1931.

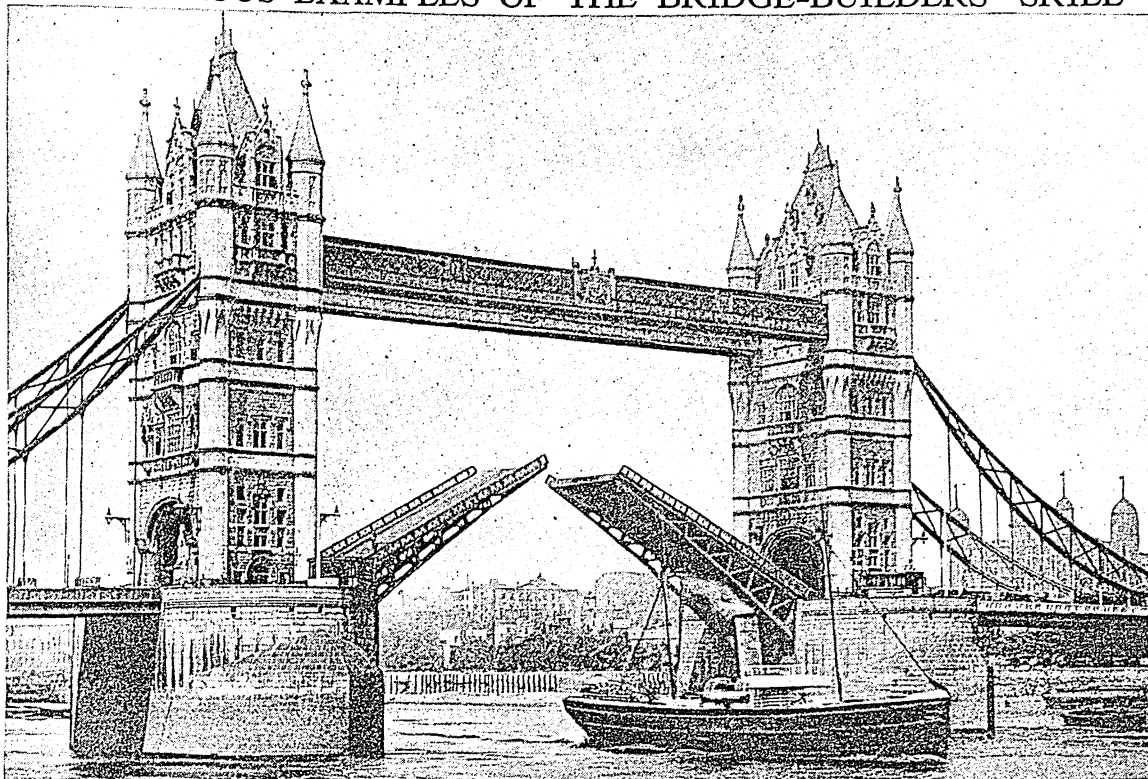
The longest clear-span cantilever bridge crosses the St. Lawrence River near Quebec; it has a clear span of 1,800 feet. It was completed in 1917, after 12 years of work, during which two incomplete structures collapsed. Scotland's Forth Bridge has the second longest clear cantilever span, 1,710 feet, and has three cantilevers in all. The Montreal-South Shore Bridge is noted for its 1,097-foot central truss.

The longest arch bridge is a steel bridge over the Kill van Kull from Bayonne, N. J., to Staten Island, N. Y. Its clear span of 1,675 feet is 25 feet longer than that of Sydney Harbor Bridge in Australia. The Plougastel Bridge at Brest, France, has the longest concrete arches, each of its three arches measuring 612 feet. The Traneberg Bridge in Stockholm Harbor comes next, with a 585-foot span. These bridges hold their records because the civil war in Spain interrupted construction of a 630-foot concrete span over the Esla River. The record lift bridge, over the Cape Cod Canal, has a 544-foot span; the longest bridge structure in Europe joins the island of Falster with Zealand on which Copenhagen stands. It was completed in 1936 and is two miles long. It has 47 girder spans and three arches.

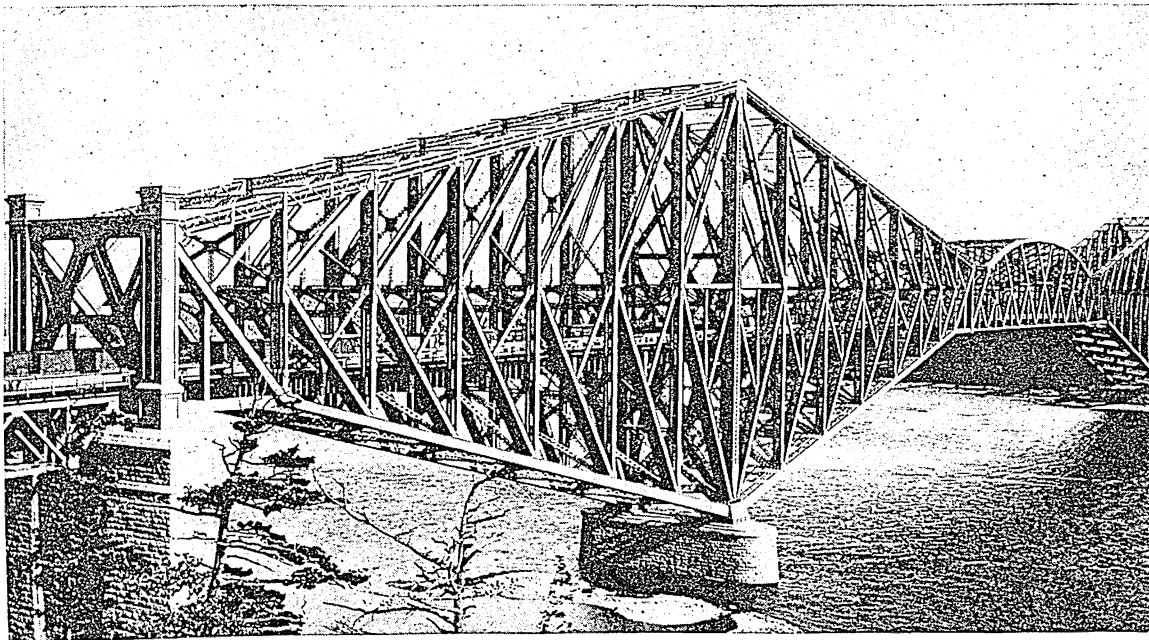
New Alloys Give Added Strength

Today engineers can clear a span of almost any length, provided foundations can be found. Of particular help in solving their problems are the new alloys, such as the British bridge steel *chromador*, which contains chromium, manganese, and copper. This alloy is so strong that its use greatly reduces the amount of metal needed for a bridge.

TWO FAMOUS EXAMPLES OF THE BRIDGE-BUILDERS' SKILL



This is the famous Tower Bridge over the Thames at London. As you pass over the driveway it has the solid appearance of an ordinary paved street. Yet when a ship approaches, this driveway splits in the center, and the two "bascules" swing up smoothly and easily, as if the two great towers were giants slowly lifting their arms. Meanwhile foot-passengers can climb the towers and cross to the upper bridge. The bascule bridge has become popular in many American cities, where a comparatively narrow shipping channel is spanned.



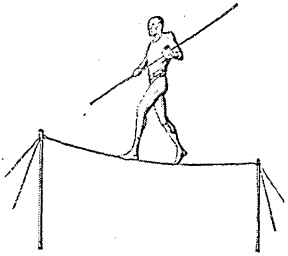
For spanning great distances the cantilever type of bridge has proved extremely successful. This famous railway bridge at Quebec, with a span of 1,800 feet, is perhaps the longest of its kind in the world. It is built in three sections, consisting of two huge brackets balanced on piers, and connected in the middle by a short truss. Such bridges can be built out from the balancing piers without a scaffolding to hold them up, for the network of braces makes them self-supporting at each step of the work.

THE BRIDGE THAT STRADDLES LIKE A LOG

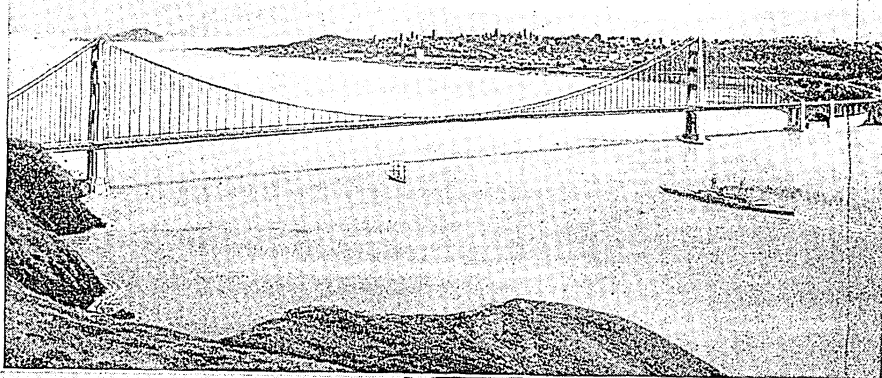


The Burlington Railroad's bridge (left) over the Ohio River at Metropolis, Ill., shows us how men use "trusses" to carry a roadway, like a log, between supports built in a river. Each structure between the piers is a "truss." The article tells how a truss works.

THE BRIDGE THAT WALKS A TIGHT-ROPE



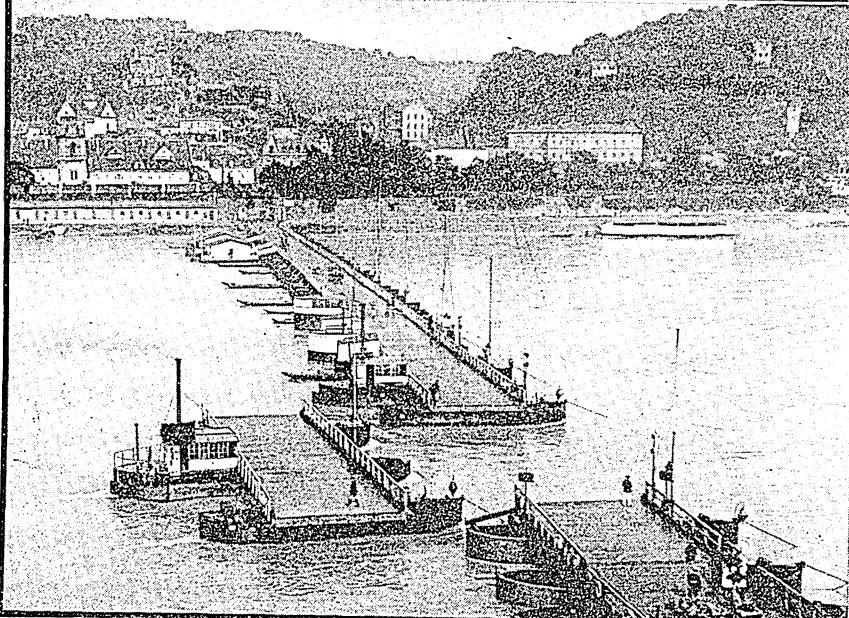
The gigantic Golden Gate suspension bridge north of San Francisco shows how a bridge high enough to let the largest ships pass is "hung from ropes," to cross very wide bodies of water.



THE BRIDGE THAT FLOATS ITSELF ACROSS



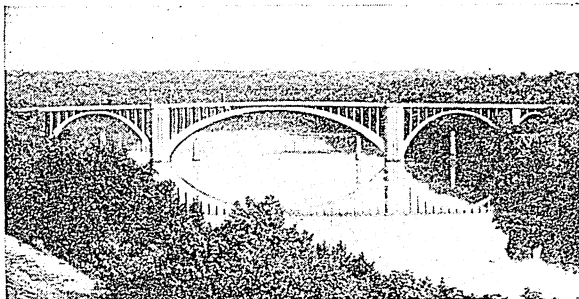
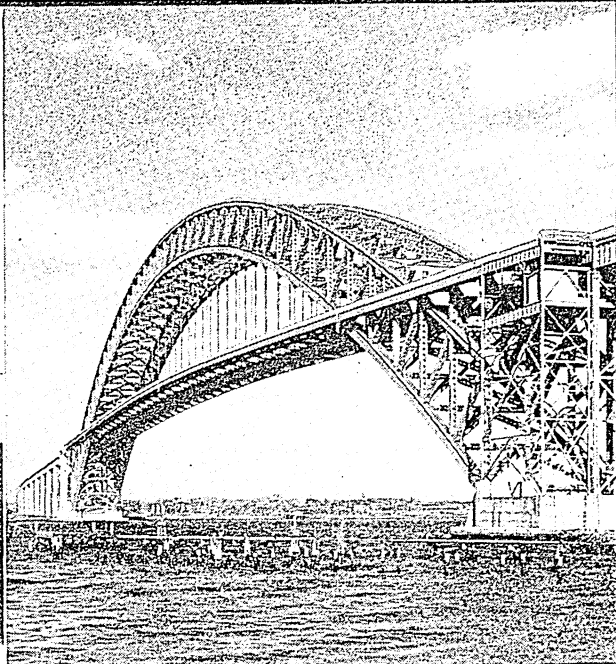
We may say that a "pontoon" bridge is like a "lumberjack jumping from log to log" in a river. Its roadway crosses on floating boats. Most pontoon bridges are for temporary use; but the one we see at the left, over the Rhine at Coblenz, Germany, is permanent. Notice how a small steamer takes away a section of the bridge whenever a river boat must go through.



THE BRIDGE THAT HUMPS ITS BACK TO CARRY A HEAVY LOAD



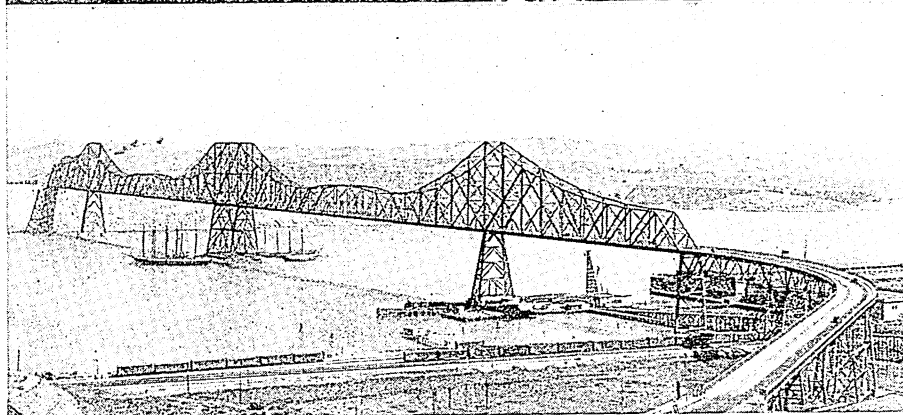
Just as workmen arch their backs to carry heavy loads, so do bridges. At the right we see how a huge steel arch crosses the Kill van Kull from Bayonne, N. J., to Staten Island. The arch is carried high enough so that the roadway can be hung below and still let ships pass under. The concrete Cappelin Memorial Bridge at Minneapolis (below) has the roadway carried over the three arches



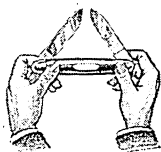
THE "BOOK-SHELF" BRIDGE



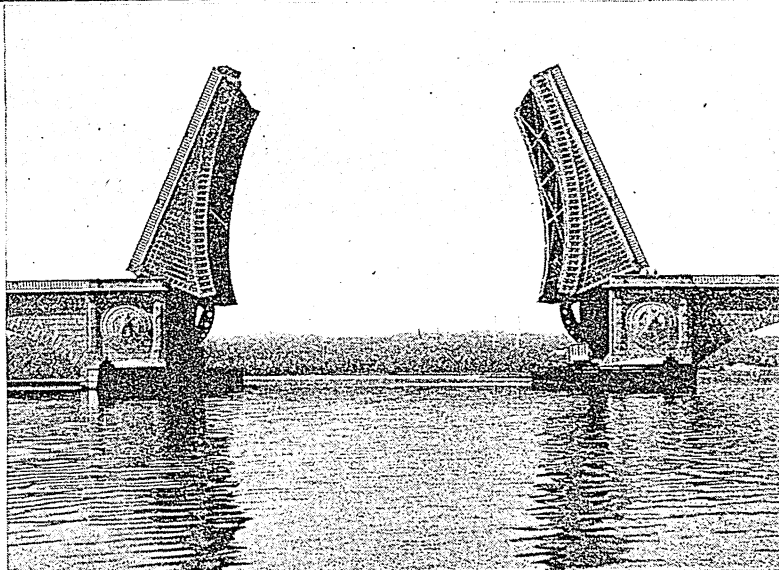
At the left the "brackets" stand out clearly, in the cantilever bridge over Carquinez Strait at the northeast corner of San Francisco Bay.



THE BRIDGE THAT FOLDS LIKE A JACK-KNIFE



When a river boat approaches a bascule bridge, machinery whirs, and up go the two "leaves," like jack-knife blades, to let the boat pass. A counterweight, concealed here, balances each leaf, so that it moves easily. We are viewing the splendid Arlington Memorial Bridge over the Potomac River between Washington, D. C., and Arlington, Va. Another noted bascule bridge is shown on page 241.



BRIDGEPORT, CONN. An excellent harbor, access to cheap fuel supplies, and a temperate climate have helped Bridgeport to become one of the chief manufacturing cities of New England. It is the industrial capital of Connecticut, and the third largest city in the state.

Bridgeport is situated at the mouth of the Pequonock River, on Long Island Sound, 56 miles northeast of New York City. It has two harbors busy with the coming and going of coastwise steamers and tow barges, which carry a tremendous volume of domestic freight. The port has complete customs facilities, and many imports are received in bond from New York City and other Atlantic ports. Main line railroad service and motor truck lines speed Bridgeport products to all parts of the nation. A large airport is equipped to accommodate both land- and sea-planes.

Nearness to the great New York market has stimulated the city's manufacturing. Sewing machines were made here as early as 1856, and the Singer Manufacturing Company now has an immense plant. The Remington Arms Company manufactures ammunition and cutlery and the Sikorsky Aviation Corporation and the General Electric Company have large factories. The city's long list of manufactures also includes brake linings, chains, corsets, electrical equipment, drugs, silverware, phonographs, typewriters, hardware, steel, tools, valves, machinery, and castings.

In housing and recreational developments Bridgeport is among the nation's leaders. Its modern home projects have attracted international interest. The greater part of the city's seven-mile water front has been converted into parks and playgrounds. The noted Seaside Park was largely given by P. T. Barnum, "the prince of showmen," who made his home in Bridgeport (*see* Barnum, P. T.). Surrounding the city are several attractive suburban towns where many Bridgeport businessmen have their homes.

Included among the city's many schools are a junior college, the Bridgeport State Trade School, and the Bridgeport City Normal School.

The first settlement was in 1639 on land bought from the Paugusset Indians. It was called Pequonock, or "broken ground," because of the near-by rolling hills. The fine harbor soon made it a trading center. In 1800 it became a borough of the neighboring town of Stratford, and in 1836 it was incorporated as the city of Bridgeport. Because of the great number of workers employed in its factories, Bridgeport has a large foreign population. Population (1940 census), 147,121.

BRISTOL, ENGLAND. The dignified old city of Bristol has from the dawn of its history been a trading center. Although located eight miles from the Severn at the junction of the Frome and Avon rivers, it can be reached by large vessels, thanks to the improved river channel and the immense docks along the Severn, and millions of dollars' worth of exports and imports pass through it every year. The city has long been noted for its glassworks, potteries, soapworks, tanneries, tobacco factories, and shipyards.

About the year 1000 a Saxon settlement began to grow up at the junction of the two rivers, and by the time of the Norman Conquest, in 1066, it had attained considerable size and importance. From Bristol the Cabots sailed on their voyage to explore the New World found by Columbus. Bristol fishermen settled Newfoundland, and it was the home of Admiral Penn, father of the founder of Pennsylvania. It was also the home of the poets Coleridge and Southey, and many landmarks recall the former glories of the town. Supreme among these relics is St. Mary Redcliffe, called by Queen Elizabeth "the fairest, the goodliest, and the most famous parish church in England." This church was built in the 13th century, while the cathedral dates back to the middle of the 12th. Some of the schools date from the 16th century. Bristol University (chartered 1909) is a noted educational center. The university and other parts of the city were heavily bombed during the second World War when the German air force sought to ruin Bristol as a port. Population, about 400,000.

The SUNSET GATEWAY PROVINCE of Canada

BRITISH COLUMBIA, CANADA. A wild chaos of forest-clad snow-capped mountains covers nearly all of British Columbia, the "Sunset Gateway" province of Canada.

Through the deep gorges and valleys between the mountains flow many swift turbulent rivers, turning and winding with an abruptness unparalleled in any other region of the world, as they strive to find their way to the sea. Here and there the mountain walls draw apart, leaving wide valleys and plateaus where fruits and cereals flourish.

On the side bordering the Pacific the mountains

Extent.—North to south, about 700 miles; east to west, about 400 miles; area, 366,255 square miles. Population, 694,263.

Natural Features.—Chief mountains: Island Range on Vancouver and Queen Charlotte Islands, Coast Range (6,000 to 8,000 feet). Rocky Mountains (8,000 to 12,000 feet; highest peak, Mt. Fairweather, about 15,300 feet). Rivers: Columbia, Fraser, Kootenay, Skeena, Finlay, Stikine, Peace, and Liard.

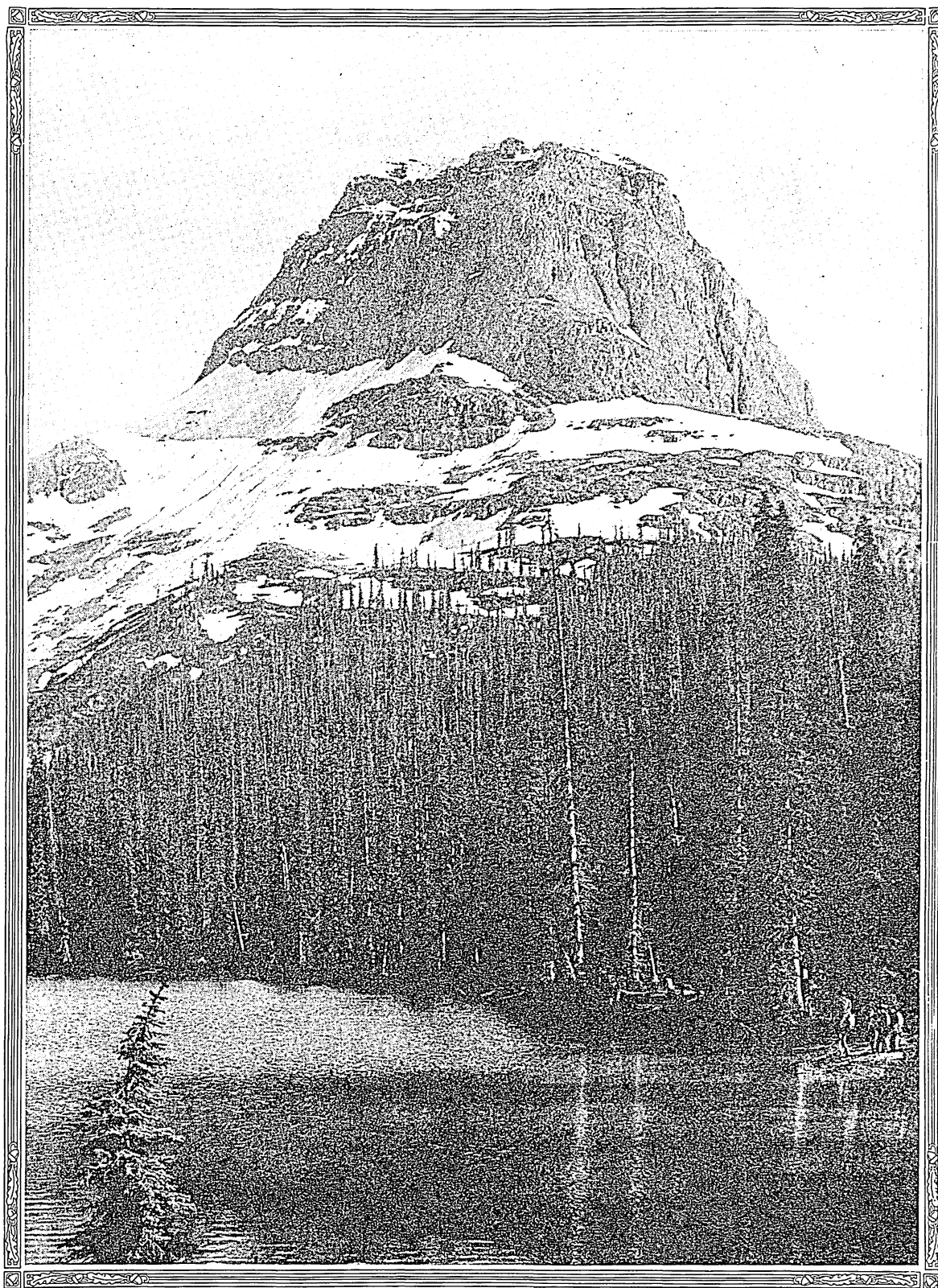
Products.—Lumber, pulp and paper, ships; wheat, oats, hay, potatoes, etc.; copper, coal, zinc, gold, silver, lead; salmon and other fish; canneries.

Cities.—Vancouver (246,593 population); Victoria (capital, 39,082); New Westminster (17,524).

have been partially submerged in past ages, giving British Columbia one of the most remarkable coast lines in the world, everywhere deeply cut by sounds and inlets and gloomy fiords walled by

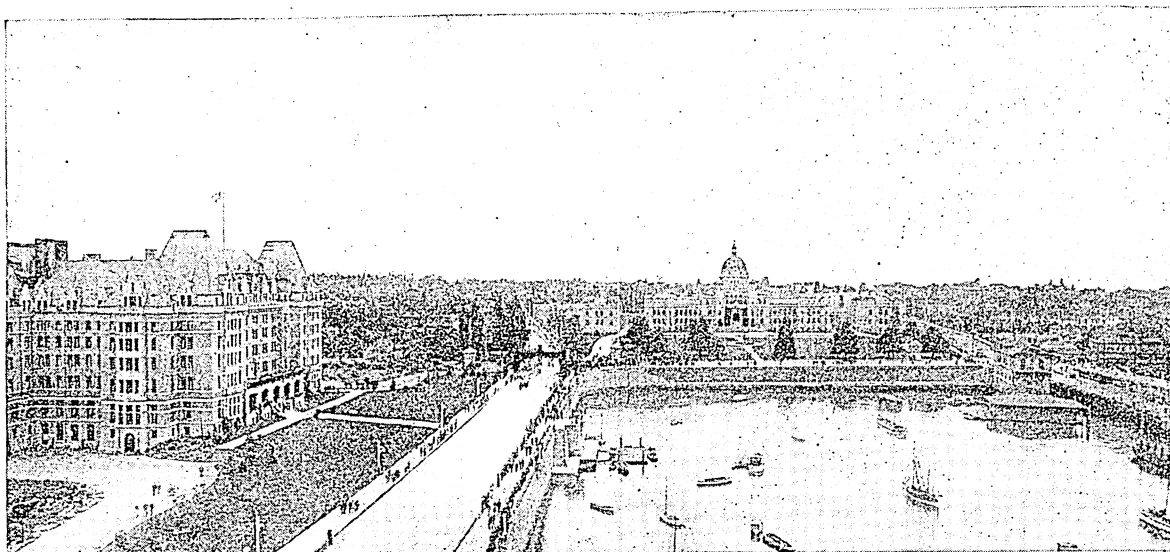
stupendous precipices, like the coast of Norway. Though the province is only about 700 miles from north to south, the coast line with all its indentations measures 7,000 miles—long enough, if straightened out, to reach to the southern tip of South America. The tops of some of the submerged mountain masses still stand above the surface of the ocean, appearing as a host of islands which thickly fringe the entire length

A SENTINEL PEAK OF BRITISH COLUMBIA



This scene is typical of the wild beauty of British Columbia. Here the Canadian Pacific Railway crosses the Continental Divide by way of Kicking Horse Pass. The peak is Mount Yoho, flanked by Wapta Glacier, source of the Kicking Horse River.

VICTORIA, CAPITAL OF BRITISH COLUMBIA



Victoria is beautifully situated at the southern end of Vancouver Island on the Strait of Juan de Fuca. In the foreground is a yacht basin and at the left the big Empress Hotel. In the middle distance rise the splendid Parliament buildings, where the government of the province is carried on. The city began as a trading post and fort of the Hudson's Bay Company, established in 1843. It became the capital of British Columbia in 1868.

of the coast. Vancouver Island, with its area of 13,500 square miles, its deposits of coal, iron, and copper, and with half the commercial timber of British Columbia, is an important part of the province. On it is the capital, Victoria. Opposite it on the mainland are the other chief cities, Vancouver and New Westminster. (See Vancouver; Victoria.)

The two chief mountain systems are the Coast Range, rising sharply from the Pacific to heights of 6,000 to 8,000 feet, and the Rocky Mountains on the eastern side, where many of the peaks tower 11,000 and 12,000 feet above sea-level, forming some of the grandest scenery in the world. Between these two systems lie other less extensive ranges, notably the Selkirks, whose wooded slopes and enormous glaciers attract thousands of tourists. Great stretches have been set aside as national parks and reserves, which are becoming the Alpine playground of America.

To the west of the Rocky Mountains is a remarkable valley, 800 miles long and from one to six miles wide. In this rise seven of the great Pacific coast rivers, among them the Kootenay, Columbia, Fraser, and Finlay. The Columbia and its chief tributary, the Kootenay, take a bewildering course through the valleys between the eastern ranges, running north and south in great loops. Although they are so close at Columbia Lake that a canal a mile long connects them, they flow on, playing hide-and-seek with each other for hundreds of miles before they meet 20 miles from the United States frontier.

Vast Natural Wealth of the Province

Untold mineral wealth—coal, gold, silver, copper, lead, zinc, iron, and petroleum—lies locked in the depths of the mountains. Already the province has yielded mineral products to the value of a billion

dollars, and the industry is still in its infancy. Three-quarters of the province is covered with valuable timber, chiefly Douglas fir, red cedar, spruce, yellow pine, larch, and hemlock. The Douglas fir, which is not found elsewhere in Canada, makes the finest building timber of America. Its gigantic size—often 300 feet high and 15 feet in diameter—makes it especially valuable for the great timbers needed for trestles and wharves. Unlimited water-power is provided by the network of streams and lakes.

In the value of its fisheries, British Columbia leads all the other provinces. On the Fraser River are to be found some of the largest salmon canneries of the world, with an output in some years exceeding \$10,000,000 in value. When the salmon come up the river to spawn some of the streams are almost literally choked with fish.

Much fine farming and grazing land is found in the valleys and river deltas and on the lower plateaus and terraces of the interior. It is estimated that there are about 25,000,000 acres suitable for cultivation, of which less than four million acres has been occupied as yet. Fruit of the finest quality is produced in the southern valleys, notably the Okanagan and Kootenay districts in the southeast, while grains thrive in the valleys farther north. Irrigation is necessary in many parts of the interior, because the warm winds from the Pacific deposit their moisture on the western slopes of the Coast Range and pass eastward as dry Chinook winds. Along the coast these warm winds create an equable climate with mild winters and abundance of rainfall, but inland the extremes of temperature become far greater, with hot summers and cold winters. In the little-explored north the winters are almost arctic, because the Rockies are

here too low to act as a barrier against the icy blasts that sweep down from the interior plains and the Arctic coast.

When First the White Men Came

It was the discovery of gold in 1858 which first led to the settlement of British Columbia. Although the province had perhaps been reached by Sir Francis Drake in 1578-79, and certainly by Spanish explorers in 1774, and Captain Cook in 1778, no efforts had been made to settle it by Great Britain, except for the trading posts of the enterprising Hudson's Bay Company. Boundary controversies with the United States were settled in 1846 and 1872. When the gold rush came in 1858, a more efficient government was needed, and British Columbia was made a crown colony. For some years British Columbia stood out against federation with the rest of Canada, but the province finally agreed in 1871 to join the Dominion on condition that a railroad be built from coast to coast. This was the origin of the Canadian Pacific Railway which, with several other great railways, brings to the port of Vancouver large quantities of grain and lumber, thus making that city one of the important shipping centers of the western coast. Another Pacific railway terminus is at Prince Rupert, at the mouth of the Skeena River, 500 miles to the north. Area of British Columbia, 366,255 square miles; population, about 695,000.

BRITISH EMPIRE. Four great events in the 18th century changed the course of human history. These were the birth of the United States, the French Revolution, the Industrial Revolution, and—last, but not least—the founding of the British Empire.

This great colonial empire, which is scattered in every quarter of the globe and on which "the sun never sets," was built up partly by successful combat with the Spanish, Dutch, and French empires which preceded it, and partly by discovery and patient settlement.

By the method of conquest England in 1713 acquired from France Nova Scotia, Newfoundland, and Hudson Bay territory, and in 1763 France surrendered to her the rest of Canada. At the same date, which marks the close of the Seven Years' War (1756-1763), French influence was overthrown in India, and British supremacy was established there also. By settlement England acquired the Thirteen Colonies, which seceded from the empire in the American Revolution, as well as important possessions in the West Indies and elsewhere. It was the explorations of Captain Cook (in 1769, 1772, 1776), and the settlement of Botany Bay (1788) and Port Nicholson (1839) that gave her title to Australia, New Zealand, and other valuable possessions in the Pacific Ocean.

In the 19th and 20th centuries the empire grew steadily in size and strength. The beginnings of her African domains had already been made on the west coast (Sierra Leone, the Gold Coast, Gulf of Guinea, and others) in the 17th and 18th centuries. Cape Colony was conquered from Holland in 1806, while

that country was aiding Napoleon against England. The Dutch republic of Natal was added in 1843. Rhodesia (now the British colonies of Southern and Northern Rhodesia) was brought under control of the empire largely by victories over the fierce Matabele tribe in 1893. The Transvaal and the Orange Free State were won in the Boer War (1899-1902), and were united in 1910 with Cape Colony and Natal to form the Union of South Africa. At the close of the World War of 1914-18, the Union, as a mandatary of the League of Nations, received German Southwest Africa. Great Britain received parts of the Cameroons and Togoland, and nearly all of German East Africa (now Tanganyika Territory). This connects British southern Africa with British East Africa (*see* East Africa), Anglo-Egyptian Sudan, and Egypt, to the north, and so assures an all-British route for the projected Cape-to-Cairo Railway. Though occupied by Great Britain since 1882, Egypt belonged nominally to Turkey until the World War, when a British protectorate was proclaimed. Its independence was restored in 1922 under British auspices. The World War also added to the empire the mandated territories of Palestine, Trans-Jordan, and Iraq (formerly Mesopotamia) in western Asia; all the former German islands south of the equator were assigned either to Australia or to New Zealand. Great Britain gave up its mandate over Iraq in 1932, but still stood ready to protect this new nation. Among the smaller of the British possessions are Gibraltar and Malta in the Mediterranean; Bermuda, some of the West Indies, and the Falkland Islands, off America's coast; Aden, Ceylon, the Straits Settlements, and Hong Kong, on the coast of Asia; and many scattered islands used as naval stations and ports of call.

Altogether about one-fourth of the total land area and about one-fourth of the whole population of the earth is included within the British Empire. But only about one-seventh of its population (including that of the British Isles) belongs to the white race. The rest are members chiefly of the black and brown races, natives of Africa and Asia.

The Secret of Britain's Power

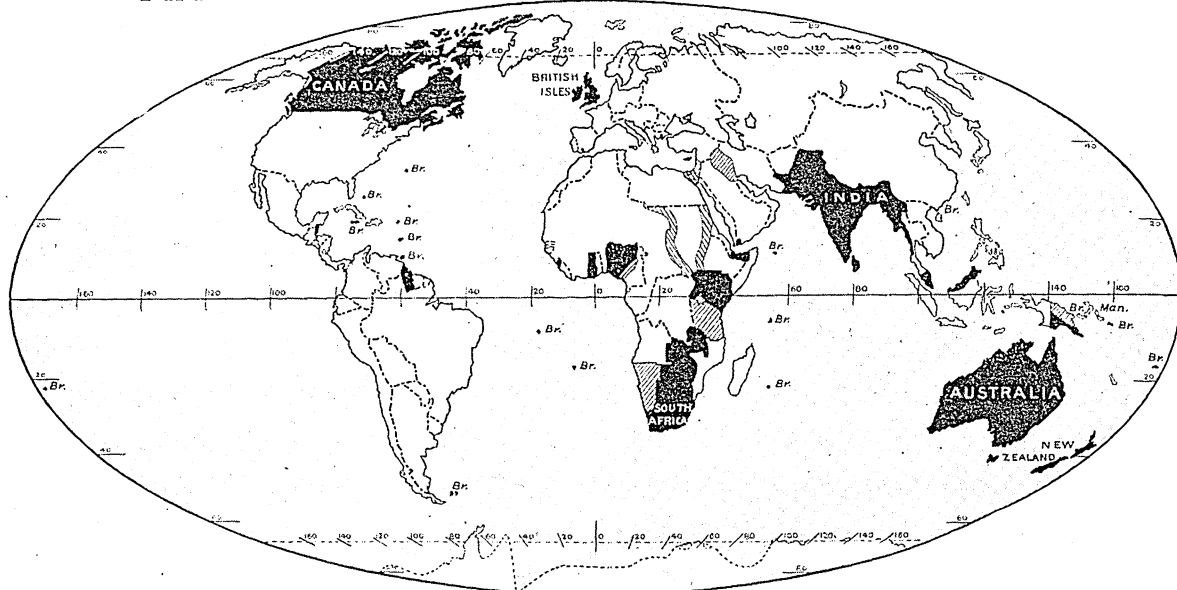
How has Great Britain succeeded where other nations failed, and managed to hold together peaceably such scattered lands inhabited by such different peoples? France and Spain lost their old colonial empires, and Holland and Portugal have only remnants left. The secret of Great Britain's success is that she learned the lesson of administering her colonies, not for her own good primarily, but for that of the colonies. This lesson was taught her partly by the successful revolt of her Thirteen American Colonies. Something also was due to the Anglo-Saxon genius for self-government, which is one of the marked characteristics of her people. Gen. Jan Smuts of South Africa, who once fought with the Boers against Britain and then became a loyal British subject, has pointed out that the British Empire is really *a commonwealth of self-governing nations* rather than

an empire in the usual sense. It is, as he says, a "league of nations" in miniature. This principle of the independent nationhood of the dominions was recognized at the close of the first World War,

Australians, South Africans and New Zealanders, and even natives of India, crossed the seas to fight for the empire.

The total area of the British Empire, including pro-

THE EMPIRE THAT ENCIRCLES THE WORLD



After a glance at this map you will realize the truth of the old saying, "The sun never sets on the British Empire." When it is midnight in London, the clocks in the faraway Fiji Islands are ringing noon. The black portions of this map indicate territory under British control. The Anglo-Egyptian Sudan (held jointly by Great Britain and Egypt) is in shaded outline. The territories under British mandate from the League of Nations are shown full-shaded.

when the dominions signed the peace treaties and became members of the League of Nations, but it did not receive formal and official statement until 1926. Then an Imperial Conference announced that Great Britain and the dominions "are autonomous communities within the British Empire, equal in status, in no way subordinate one to another in any aspect of their domestic or external affairs, though united by common allegiance to the crown and freely associated as members of the British Commonwealth of Nations." The right of each dominion to direct its own foreign relations and to send diplomatic representatives to other nations was conceded.

The Imperial Conference of 1930 settled additional questions of policy, and the British Parliament ratified the new status of the dominions by passing the Statute (or Act) of Westminster in 1931. The rest of the empire, however—India, and the colonies and protectorates—is under the direct control of Great Britain alone. Many of these territories are crown colonies in which legislative and executive power is controlled by Great Britain.

Upon the outbreak of war against Germany, both in 1914 and in 1939, the empire rallied to the support of Great Britain. In September 1939 all the members of the British commonwealth save Ireland (Eire) declared war against Germany. They gave economic and military support to the mother country, just as in the World War of 1914-18 when Canadians and Aus-

tratorates and other territory, is about 13,306,000 square miles; its population, more than 500,000,000. (See also England, and articles on the great self-governing dominions and India.)

BRITTANY, FRANCE. Wherever the French flag waves over a fishing-schooner, a trading vessel, or a warship—whether it be on the Banks of Newfoundland, on the China coast, along the fever-soaked shores of Africa, or among the tiny islands of the Pacific—you will find the sons of Brittany, those black-haired thick-shouldered sailors from the rock-bound peninsula which France thrusts westward into the Atlantic. For this province is inhabited by a seafaring race which for centuries has lived a life apart, gathering its living largely from the ocean or by cultivating the stony soil with patient obstinacy.

"The Breton peasant," say the French, "fears God and the sea and nought else in the universe." Indeed, these descendants of an ancient Celtic race have clung far more closely than other Frenchmen to their old religious faith. Everywhere along the wayside one comes upon tall crucifixes, and men in long blouses and wooden shoes, or women in quaint native costume kneeling before them. Nearby perhaps is a small church and a cemetery, with many crosses over empty graves, telling of brave men lost at sea.

The people of Brittany are melancholy and gloomy like the ocean fog, or gay and boisterous like the dancing wave. They are fierce fighters, with tempers

like the storms which smash against their coasts. They settle their private difficulties most often with their fists, avoiding law courts as much as possible. In time of war they fight for their country with equal courage and zeal.

But under the influence of modern industrial progress, the quaint old customs and costumes of Brittany are rapidly passing away. Its biggest seaports have become great naval stations or trade centers. Abundant crops are being raised in the river valleys, especially in the north where modern agricultural methods have been introduced. Among the important towns are the seaports of Nantes, Brest and St. Nazaire, and Rennes, the capital of Brittany in the old days when it was a semi-independent duchy.

In olden times this land was the home of the Armorican tribes, which came under Roman control about 51 B.C. Celtic fugitives from Britain, fleeing from the Anglo-Saxon invaders of the 5th and 6th centuries, settled in this peninsula and gave it the name of Brittany, "Little Britain." Through stormy generations it remained, most of the time an independent duchy, until it was incorporated with France in 1532.

Brittany has given many great men to the world, among them the medieval scholar Abelard, the explorer Jacques Cartier, the writers Chateaubriand and Ernest Renan.

BRONZE. Very early in the history of civilization men learned to mix copper and tin to make an alloy we call bronze. This mixture was harder than either copper or tin alone, and was used for swords, axes, arrow tips, and other weapons, before iron came into use. For this reason the period which followed the Stone Age of man's history has been generally called the Bronze Age.

In Europe this period seems to have commenced some time between 2000 to 1800 B.C.

Bronze is used in modern times to make big bells, for it has a rich tone when set in vibration by a sharp blow. By varying the quantities of tin and copper, the qualities of bronze may be greatly altered. In general the more tin that is used, the harder and more brittle will be the alloy. Bronze is also used for statuary, and for many art and industrial purposes.

The bearings of much heavy machinery, like the rings in which the propeller shafts of big ships revolve, are often made of a substance called "phosphor

bronze," in which a small amount of phosphorus acts as an additional hardening agent. An alloy called "aluminum bronze," in which the tin is almost entirely replaced by aluminum, is used for vessels which must withstand the corrosive action of certain chemicals. (See Alloys; Copper and Brass.)

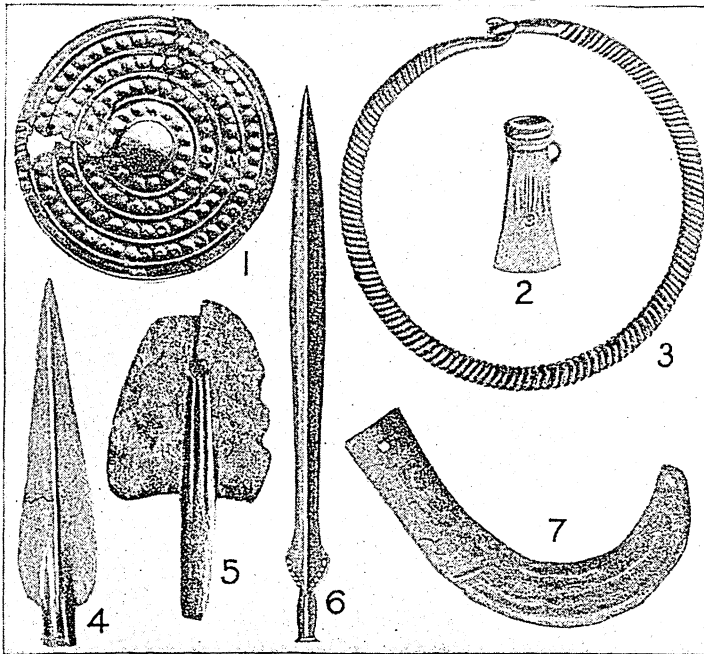
BROOKLYN, N.Y. In 1898 Brooklyn, then the fourth largest city in the United States, was merged in greater New York. It lies at the west end of Long Island, across the East River from New York, with which it is connected by three huge suspension bridges, several subway tubes and railway tunnels, and ferries. Although called "the sleeping room of New York City," Brooklyn is in reality one of the greatest manufacturing communities in the United States. It is one of the leading centers in sugar refining, the milling of coffee and spices, and the manufacture of shoes, tobacco, knit goods, silk

goods, clothing, metal products, millinery, lace goods, and food preparations. The Navy Yard at Brooklyn is one of the chief naval stations in the United States. As a borough of New York City, Brooklyn has its own president and controls local improvements, such as streets and sewers.

The Dutch made the first settlement in 1636. Ten years later the town was organized. It was named "Breuckelen," after a town in Holland. At the time of the American Revolution it had become a village of 3,500 inhabitants. On

August 27, 1776, Washington was defeated in the battle of Long Island, fought on the site of Brooklyn, and the village was held by the British until the evacuation of New York at the end of the war. At Fort Green (now Fort Green Park) were buried 11,000 Americans who died on British prison ships. In 1816 Brooklyn was incorporated as a village, and as a city in 1834. Subsequently Williamsburg, Flatbush, and other suburbs were annexed; and in 1898 this enlarged Brooklyn was united with New York City across the East River. Population (1940 census), 2,698,285. (See New York City.)

RELICS OF THE BRONZE AGE



These prehistoric articles of bronze, dug up in England, tell us something of the civilization of the Britons before the coming of the Romans. The round shield (1) was found in the Thames River; the "celt" (2) is a chisel-shaped weapon with a socket in which fitted a handle; the other relics are a bracelet (3), a spear head (4), a strange and deadly looking razor (5), a long dagger (6), and a crude sickle (7).

BROOMS AND BRUSHES. Brooms are now made almost entirely by machinery. First, dried fibers of the broom-corn plant are attached to a long handle, and a winding machine wraps wire around the ends of the fibers as they surround the handle. Then the broom, now cone-shaped, is put into a vise, flattened, and sewed with heavy twine to hold it in shape. A scraping machine removes most of the broom-corn seeds still attached to the fibers, and trimming of cloth, yarn, or metal is put on if desired. Whisk-brooms are made in much the same way.

More than nine-tenths of our brushes are made of hog bristles, though the hair of the red sable, camel's hair (really taken from a squirrel), and other animals is used for fine artists' brushes. Scrubbing brushes are made usually of vegetable fibers. The most common are rice root grass or Mexican whisk, grown chiefly in Mexico; kitool (or kittul), a brownish-black fiber extracted from the leaf stalks of the jaggery palm of India and Ceylon; Tampico fiber or istle, chiefly from the agave of Mexico; and bristle fiber or *coir*, the husk of the coconut palm. In cheaper brushes the tufts of bristles or fibers are merely bound with thread, dipped into melted pitch, and twisted into holes bored in the wooden back. Better grades are made by binding the tufts with wires, which are drawn through the holes and woven together. A veneer is then glued or cemented to the back. For artists' brushes the outer tips of the hairs are set in a cap to shape the brush, and the roots are cemented or glued into the handle.

Benjamin Franklin was first to grow broom-corn in the United States, though it has been raised in Europe for over 300 years. Its origin is unknown. Broom-corn differs from the other common sorghums in that it bears heads with long seed-bearing branches which form a brush. When cured, or dried, these branches make the "straws" in brooms. Illinois, Oklahoma, Kansas, Colorado, and New Mexico are among the states producing broom-corn. An acre will produce 500 to 600 pounds of brush under good conditions. Scientific name, *Andropogon sorghum*.

BROWN, JOHN (1800-1859). The Civil War between the Northern and Southern states might have been delayed for several years but for John Brown's ill-fated raid on the government arsenal at Harper's Ferry, in October 1859. His subsequent death on the scaffold had the effect of crystallizing opposing opinions on the slavery question, and so hurried a divided country toward the supreme test of arms.

Born in Torrington, Conn., and descended from Peter Brown, carpenter of the *Mayflower*, this early abolitionist had all the piety, uprightness, and willingness to die for a cause that marked his Puritan ancestors. While a young man his eyes were so weak as to forbid sufficient study, thus preventing his preparation for the ministry. As a wool-grower, farmer, leather dresser, and surveyor, he and his large family of children dwelt successively in Ohio, Pennsylvania, Massachusetts, and New York, always brooding with the fervor of an Old Testament prophet on the sin of negro slavery, against which he swore eternal war. Such was his strength of character that

he made unfaltering converts of his young children and, when they grew up and married, of their wives and husbands. The whole family had a sense of dedication to a sacred cause.

At John Brown's command his sons emigrated to Kansas, in 1854, to aid in bringing that territory into the Union as a Free-Soil state. He soon followed them and played a leading part in that border warfare of bitterly contested elections and bloody fights. One of his sons was killed in the course of it, and another bore all his life the marks of prison chains. In a famous battle at Osawatimie, with only 15 men, he held off 500 pro-slavery Missourians and won the nickname of "Osawatimie Brown."

When the Kansas question was settled in favor of freedom, he formed a mad scheme for making war upon slavery in the South itself. On a rented farm at Hagerstown, Md., he gathered a few men, and on the night of Oct. 16, 1859, attacked the little town of Harper's Ferry. His purpose was to seize the United States arsenal there and procure arms for a slave uprising. He easily mastered the town and the arsenal, but was besieged by the local authorities, who were soon reinforced by a company of United States marines from Washington under Col. Robert E. Lee. Of the 22 men who participated in his raid, ten were killed, seven taken prisoners, and five escaped. Two of the killed men were Brown's own sons, and he himself was seriously wounded. As soon as his wound permitted he was tried for "treason, and conspiring with slaves and other rebels, and murder in the first degree." He was convicted and was hanged on December 2. His bearing at the trial produced an extraordinary impression of heroic simplicity and purity and grandeur of character. Within two years his tragic end took on a historical significance when Union armies marched to battle singing—

John Brown's body lies a-mouldering in the grave,
But his soul goes marching on.

BROWNING, ELIZABETH BARRETT (1806-1861) This gifted poet and wife of Robert Browning was such a precocious child and lover of verse that she read Homer in the original Greek at 14. Feeling social wrongs deeply, she wrote 'The Cry of the Children', a fine and poignant lyric that helped to rescue little ones from labor in English factories. An invalid most of her life, Robert Browning called her "a soul of fire in a shell of pearl." They were married in 1846 and he carried her away to Italy, where by the tenderest devotion recorded in literary history he kept her alive for nearly sixteen years. When she died in 1861 the city of Florence marked the house in which she had lived (called *Casa Guidi*) with a tablet, in gratitude for her sympathy with the Italian struggle for liberty. Her best known writings are her 'Sonnets from the Portuguese', in which she pours out her love for her poet husband-to-be; 'Casa Guidi Windows', dealing with the Italian patriotic struggle of 1848-49; and 'Aurora Leigh', a romantic narrative poem.

BROWNING, ROBERT (1812-1889). Although he has been called "the scholar's poet," and not without good reason, no poet was more intensely alive and human than Robert Browning, nor felt more keenly the joy of life. He inspired the whole world with strength and courage and faith, when he sang:

The year's at the spring
And day's at the morn;
Morning's at seven;
The hillside's dew-pearled;
The lark's on the wing;
The snail's on the thorn;
God's in His Heaven—
All's right with the world.

Browning's life was happy and harmonious, free from the poverty that has burdened so many poets. His father, a man of strong literary and artistic tastes, encouraged the boy in his love for books and art and music. Given the run of his father's great library, in his boyhood home at Camberwell in the outskirts of London, he read not only Byron and Shelley and Keats, but many books far beyond his years. Before he could write he had begun to compose verses, and by the time he was 12 he had already completed a volume of poems. His first published poem, 'Pauline', appeared when he was 21, and his poetic career continued unbroken for half a century.

His meeting with Elizabeth Barrett was the beginning of the most beautiful romance in literary history. After their marriage in 1846, they went to Italy and lived an ideally happy life there until Mrs. Browning died in 1861. Bearing his loss with steadfast courage, Browning turned to writing with even greater energy than before. Most of his time was now spent in England, with occasional visits to Italy. He died in Venice, not long after writing the lines which describe himself so faithfully:

One who never turned his back, but
marched breast forward,
Never doubted clouds would break,
Never dreamed, tho' right were worsted,
wrong would triumph.
Held we fall to rise, are baffled to fight
better,
Sleep to wake.

Much has been said about the difficulty of reading Browning. It is true that he is often obscure. He is so filled with the thoughts he wishes to express that he is not always so careful as he might be about the form, and sometimes these thoughts are too profound or too subtle to be expressed with exactness. Many of his poems are crowded with allusions to the out-of-the-way information which he picked up in his reading, and which means nothing to the ordinary reader. Probably the most obscure of all his works is 'Sordello', of which Tennyson said that there were only two lines he could understand, the first, "Who will may hear Sordello's story told," and the last, "Who would has heard Sordello's story told,"—and these, he jokingly remarked, were both lies. But this will not frighten you, if you know the

THE BROWNING'S IN THEIR BELOVED ITALY



"Open my heart and you will see graved inside of it 'Italy'," wrote Robert Browning to tell of his love for that sunny Mediterranean land. Here we see a drawing of the poet and his poet wife, with their little son, Robert, on a trip through the Grand Canal in a gondola in that most picturesque of all Italian cities—Venice.

delightful 'Pied Piper of Hamelin', the rollicking 'Cavalier Tunes', and such stirring ballads as 'Hervé Riel', and 'How They Brought the Good News from Ghent to Aix'. Among the poems which carry a deeper message, and which thoughtful boys and girls will appreciate and love more and more as they grow older, are 'Pippa Passes', 'The Boy and the Angel', 'Evelyn Hope', 'My Star', 'One Word More', 'The Lost Leader', 'Saul', 'Rabbi Ben Ezra', and 'Prospice'.

Browning's longest, and, as many think, his greatest, work is 'The Ring and the Book'. This poem, suggested by an old yellow book which he picked up in Florence, tells the story of a murder from 12 different points of view. It shows Browning's wonderful ability to reveal character from within and to see through the eyes of others. This power of "psychological analysis," as the critics call it, would have made Browning a great dramatist, had he not been too much concerned with the inner workings of the mind and too little with outward acts for a successful playwright. Some of his dramas, however, such as 'The Blot on the Scutcheon' and the historical play 'Strafford', are well worth reading.

Among Browning's chief publications are: 'Pauline' (1833); 'Paracelsus' (1835); 'Sordello' (1840); 'Bells and Pomegranates' (1841-46); 'Men and Women' (1855); 'Dramatis Personae' (1864); 'The Ring and the Book' (1869); 'Dramatic Idyls' (1879-1880); 'Asolando' (1889).

BRUCE, ROBERT, KING OF SCOTLAND (1274-1329). A fugitive lay on a bed of straw, heart-sick with discouragement. Idly he watched a spider hanging from its web and trying to swing itself from one beam to another of the wretched cottage roof. Six times the spider tried and failed. "If it tries again and is successful," said the fugitive to himself, "I too will make another attempt." On its seventh attempt the spider was successful.

This fugitive was the Scottish hero Robert Bruce, crowned king of Scotland after Wallace was defeated by the English (*see* Wallace, Sir William). Taking heart from the spider's success, he now won back one stronghold after another. At last on the memorable day of June 24, 1314, the English and Scotch forces met in the great battle of Bannockburn, which was to decide the fate of Scotland.

The great army of Edward II came pouring over the border. Bruce had not half so many men, but what he lacked in numbers he made up in courage and in skill. He chose a strong position. On one side flowed the little stream called the Bannock, with steep rocky banks; on the other rose Stirling Castle. In front were bogs and marshes, and wherever the land was firm, Bruce had pits dug to entrap the enemy's horsemen. The poet Robert Burns makes Bruce address his men in these ringing words:

Scots, wha hae wi' Wallace bled—
Scots, wham Bruce has aften led—
Welcome to your gory bed,
Or to victorie!

The skilled English archers were unsupported by the English cavalry and were forced to retire. When

the mail-clad knights advanced they stumbled in the pits which the Scotch had dug for them, and found themselves helpless before the forest of leveled spears of Bruce's men. Presently from behind the Scottish ranks what appeared to be a fresh army was seen advancing. In reality it was only the servants, drivers, and other camp followers whom Bruce had sent behind a hill, and who now came forward to join the fight. The English were thrown into confusion, and the day closed with one of the bloodiest defeats they had ever suffered. Bruce's throne and Scotland's independence were thenceforth secure.

Bruce proved a wise king as well as a brave warrior, and during his reign (1306-1329) gained the title of "good king Robert." In his later years he longed to go to the Holy Land to fight against the heathen who were again in possession of the Sepulcher of Christ. He was the more anxious to do this because his soul was troubled at the thought that when a young man he had slain a rival before the very altar of God. When he knew that he must die without fulfilling his heart's desire, he called his faithful friend Lord James Douglas to him, and begged him to take his heart after death and carry it to the Holy Land.

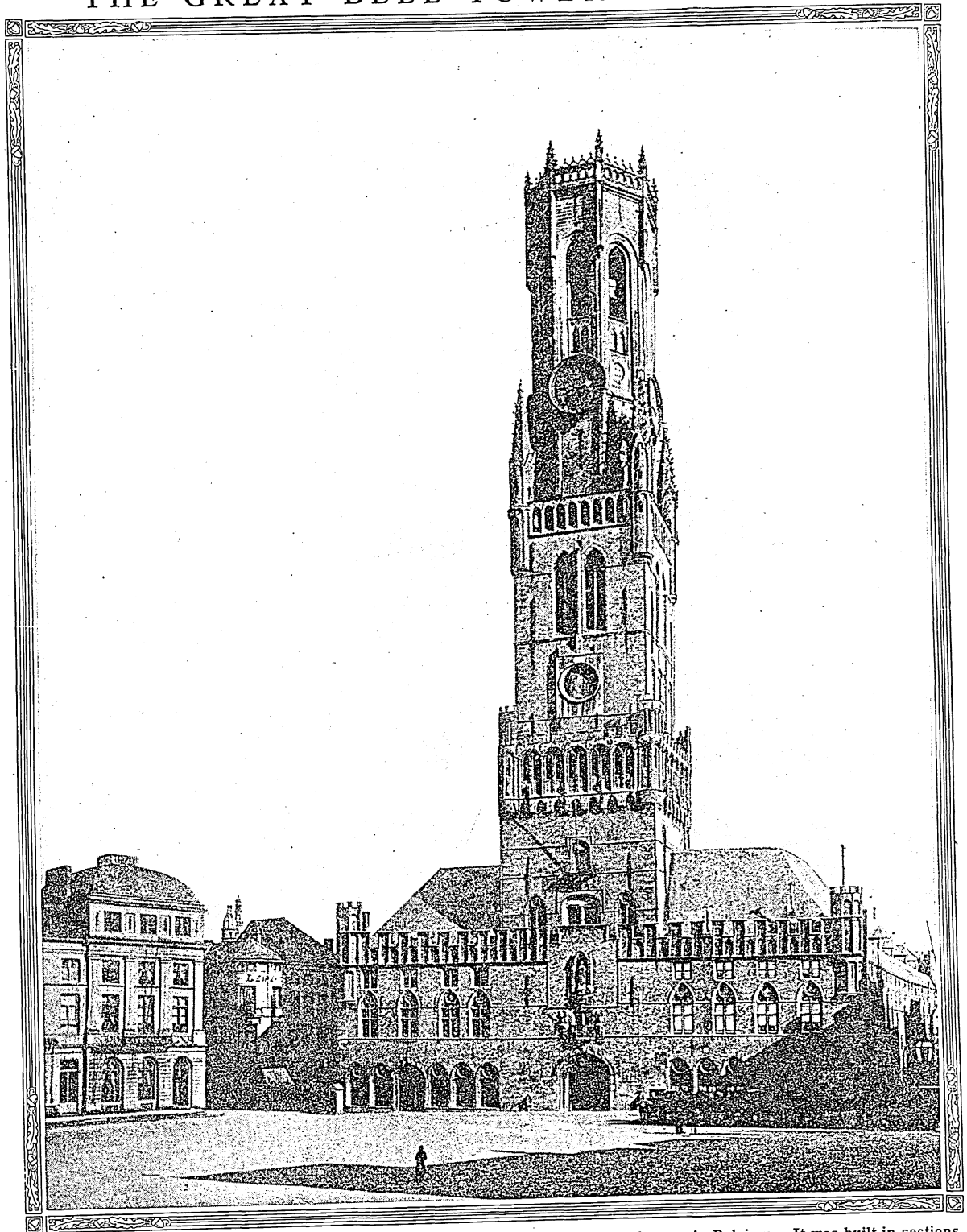
When Bruce died, Douglas put the king's heart in a silver casket and started with it for the Holy Land. In Spain he found the Christians hard pressed by the Mohammedans and went to their aid. In the heat of the battle he threw Bruce's heart into the midst of the infidel host, crying: "Go thou before as thou wert wont to do, and Douglas will follow!"

The brave Douglas perished in the battle, but one of his knights recovered Bruce's heart. Deeming that it had done full service against the infidel, he carried it back to Scotland, where it is buried in Melrose Abbey.

BRUGES (*brüz*), BELGIUM. Quaintest of the many old Flemish towns is Bruges, which lies 55 miles northwest of Brussels and about eight miles from the North Sea. It is intersected and surrounded by many canals, which connect it with Zeebrugge its seaport, with Ostend, and with many other places. Crossing these canals are 50 bridges—all opening in the center to permit the passage of boats—and thus the city gets its name, Bruges, meaning "bridges."

In modern times this Venice of the North has dreamed peacefully of the days long past when it was one of the richest jewels in the crown of its sovereigns, the rich and powerful counts of Flanders—when its woolen trade flourished to such an extent that Philip the Good, in 1430, founded there the order of the Golden Fleece, in compliment to the growth of that industry. Tourists came from far and near to admire the monuments of that great epoch in its history—the beautiful Gothic church of Notre Dame (13th and 14th centuries), with its many art works and its splendid tombs of Charles the Bold and his daughter Mary of Burgundy, the old market hall with its famous chimes of 48 bells, and many other notable edifices. Other Flemish towns may have presented

THE GREAT BELL TOWER OF BRUGES



In the center of Bruges stands this old Market Hall, whose tower is one of the most famous in Belgium. It was built in sections, the lower part in the 13th century, the middle section in the 14th, and the top in the 15th. Its crowned peak rises 352 feet above the street, and concealed in these lofty walls is a chime of 48 bells, one of the most famous chimes in the world. Three times a week a program of musical selections is played. The summit of the tower, reached by a winding flight of 402 steps, commands a wonderful view of the city, and of the country stretching toward the sea, eight miles away, where stands the harbor of Zeebrugge.

an equally picturesque appearance, but none was so famous as Bruges. A rival of Venice, it was a world center of commerce in the 14th century. It lost that prestige about 1490 after silt had ruined its harbor on the river Zwyn, and now it has little world trade. Lace and furniture are among the chief manufactures.

Its port Zeebrugge was occupied by the Germans in the World War of 1914-1918 and used as a base for submarine raids. In 1918 the British sank concrete-filled ships in the mouth of the port to "bottle up" the submarines. In 1940, when the Germans again occupied Zeebrugge, the British repeated this feat. Population of Bruges (Flemish *Brugge*), about 52,000.

BRUSSELS, BELGIUM. The capital and the largest city of Belgium, and an important commercial and industrial center, Brussels is famous as well for charm and beauty. It is a center of fashion and art, a city with many modern buildings and other public improvements, yet with a number of quaint and picturesque survivals of the Middle Ages.

About 60 miles from the North Sea, Brussels is almost in the center of Belgium and in the heart of its best farm region. This loamy upland, called the Belgian plain, produces some of the world's richest yields of wheat, oats, rye, and sugar beets.

The central position of Brussels gives it a large trade in these and many other products. Its roads, canals, and railways connect it with the ocean, with other Belgian cities, and with neighboring lands. The city is noted for its manufacture of Brussels lace and fine carpets and for its curtains, furniture, and books. It has sugar refineries, soap factories, foundries, engine shops, and many other industries. The manufactures and commerce suffered severely during the four years of German occupation in the World War of 1914-1918. The Germans wrecked factories, seized machinery, and took over vital raw materials. In May 1940 Brussels was again captured by German soldiers, and important roads and railway stations outside the city were heavily bombed.

Like Paris, Brussels is a city of shaded boulevards, open spaces, and beautiful parks. The Grand' Place, or market place, is one of the most interesting public squares in Europe, being surrounded by many fine old buildings in marked contrast to the otherwise modern character of the city. The largest and most beautiful of these buildings is the Hôtel de Ville, or town hall, built in the Gothic style in the early 15th century. Its belfry, 370 feet high, is crowned with a statue of St. Michael, the city's patron saint, and the face of the building is richly adorned with statuary. Within its shadow Count Egmont and Count Horn, with other gallant patriots who took part in the uprising of the Netherlands against Spanish rule in 1568, were put to death by the ferocious Duke of Alva.

This square is in the lower city, now devoted mainly to manufacture and commerce. The upper town contains the great offices of state, and other public buildings, and the mansions of the ruling class. On the hillside is the cathedral of Sainte Gudule and Saint

Michael, a noble specimen of medieval architecture, dating from the 13th century, with pointed Gothic towers and rich stained-glass windows. The Royal Library, the museums, and art galleries contain priceless treasures, including wonderful examples of Flemish art—by the brothers Van Eyck, Roger van der Weyden, Hans Memling, Rubens, and a host of other artists. Among the public buildings erected in modern times are the king's palace, the house of parliament, and the magnificent Palace of Justice (completed in 1883). The University, founded in 1834, is the most important of the city's many educational institutions, and is notable as almost the only university in Europe founded without the cooperation of either the church or state. Population of Brussels and suburbs, about 835,000.

Brussels (*Bruzelles* in French, the official language) was founded, according to tradition, in the 6th century, and received its name (*broek* means "marsh") from the nature of the site. Its growth was slow until the days of the Burgundian dukes in the 15th century, when it became one of the important cities in the Netherlands. It was the scene of the first rising of the Netherlands against Spain (1566), but remained under Spanish rule after the Dutch Netherlands had made good their independence. It passed to Austria in 1713, following the wars of the Spanish Succession. After a brief period of French rule during the French Revolution and the First Empire, it, with other parts of Belgium, was incorporated with Holland into the Kingdom of the Netherlands. In 1830 Brussels was the chief center of a revolt which separated Belgium from Holland, and it has since (except during the German occupations) been the capital of Belgium.

BRYAN, WILLIAM JENNINGS (1860-1925). Although he was three times defeated for the presidency of the United States, William Jennings Bryan molded public opinion as few of our presidents have done. For many years he was the leader of the Democratic party, and it was his influence that won the Democratic presidential nomination for Woodrow Wilson in 1912.

Bryan was born and educated in Illinois and practiced law there until 1887, when he moved to Nebraska and speedily made a reputation as one of the foremost orators of the day. In 1890 he was elected to Congress, where he was at once placed on the ways and means committee, an honor that is usually reserved for those who have served in the house for years.

Six years later, at the age of 36, Bryan achieved national fame, and received his first nomination for the presidency, when he swept the national Democratic convention off its feet by an impassioned appeal for free and unlimited coinage of silver in the ratio of 16 parts of silver to 1 part of gold. Turning to those who wished to keep gold as the money standard, he exclaimed: "You shall not press down upon the brow of labor this crown of thorns. You shall not crucify mankind upon this cross of gold."

Though Bryan failed of election then, and again in 1900 and 1908, he was still regarded as the leader of the party. By his weekly—later monthly—paper called *The Commoner*, and by the lectures which he delivered from Chautauqua platforms in all parts of the country, he did much to advance the causes of

prohibition, of religion, and of morality. In the national convention of 1912 he opposed the reactionaries.

Named secretary of state by President Wilson, he negotiated treaties with 30 countries, representing three-fourths of the world's population, for investigation of disputes before resorting to war. Because of his opposition to war, he resigned office in June, 1915, in protest against the President's firmness concerning the *Lusitania*. When war came, however, he supported the government.

After the war, he moved to Florida and worked to advance moral and religious causes. He died in July, 1925, in Dayton, Tenn., where he had been helping prosecute a case involving an "anti-evolution" law. **BRYANT, WILLIAM CULLEN** (1794-1878). In 1811 a 17-year-old boy of Cummington, Mass., was musing one day about the great facts of life and death. His musings naturally fell into metrical form, for he had been writing verses before he donned long trousers. Later his father, a country doctor, sent the poem to the editor of the *North American Review*. It was published in 1817 and won instant fame for the writer.

The poem was 'Thanatopsis,' the first great poem written by an American, and the writer was William Cullen Bryant, "father of American poets." At the age of 10 this young prodigy had published a poem in a country newspaper and at 14 he prepared a collection of poems which was put out in book form and soon ran into a second edition. This was 'The Embargo', a political satire criticizing the policy of President Jefferson, which attracted wide notice.

The publication of 'Thanatopsis' marked an epoch

in American letters. In the early days of the Republic its readers were slavish imitators of English patterns. 'Thanatopsis' was the first genuinely American poem, based on independent and original thinking and inspired by our own American landscape.

Bryant had, of course, read the English poets and had admired some of them intensely. Those to whom he felt most akin were Cowper, Coleridge, and Wordsworth, because they too loved nature. And yet he could read their poems without copying their ideas and forms. He wrote 'Thanatopsis' in a noble, rolling rhythm all his own, and he took Nature as he found her—austere with a dignity that made even death sufficiently beautiful and inevitable to make him scorn the man who feared it.

It is Bryant's poetry that raises his head above the crowd, and yet original verse occupied a very small part of his days. He studied law as a boy, but did not practice it long. For fifty years and more he edited the *New York Evening Post*. America, as E. C. Stedman says, "called for workers, journalists, practical teachers. If after accomplishing their daily tasks they found time to sing a song, it thanked them and did little more." When it is remembered that Bryant wrote several books of travel, and made many public speeches, translated Homer's 'Odyssey' and 'Iliad' into blank verse, and edited an extensive American history in addition to his newspaper work, it is not astonishing to find that his original verse filled only a few thin volumes.

Among Bryant's most famous poems are 'Thanatopsis', 'To a Waterfowl', 'A Winter Piece', 'The Death of the Flowers', 'Song of Marion's Men'.

The 15th PRESIDENT of the UNITED STATES

BUCHANAN, JAMES (1791-1868). The 15th President of the United States was a man who held almost every honor which the American people could give him, and yet he retired from public life under a cloud of deserved rebuke, such as has seldom fallen upon a president of our country. He once referred to himself as an "old public functionary"—which was an apt name, for he was in public office almost continuously from the time he was 23 years old until his retirement from the presidency at the age of 70.

Buchanan did not have to fight his way in life by his own efforts, as did Lincoln; nor did he, on the other hand, have such able assistance as did John Quincy Adams. His family belonged to the great middle class of American people. They were Scotch-Irish, who had settled near Mercersburg, Pa., in the latter part of the 18th century. His father was a merchant as well as a farmer, and in these two callings he made enough wealth to maintain his large family in comfort. His son James gives this account of his own education: "After having received a tolerably good English education, I studied the Latin and Greek languages at a school in Mercersburg. I was sent to Dickinson College in the fall of 1807, where I entered

the junior class. The college was in a wretched condition, and I have often regretted that I had not been sent to some other institution." After graduation Buchanan studied law and was admitted to the bar in 1812. Two years later he began his public career as a member of the Pennsylvania state legislature.

Buchanan and the War of 1812

At that time the country was engaged in its second war with England, a war which Buchanan, as a Federalist, had opposed before it was declared, but afterwards urged the people to support. He himself volunteered to help defend Baltimore, but he was never called into active service. That he never approved of the war is shown by a speech which he made after peace was declared, in 1815, in which he stated that it had been "glorious in the highest degree to the American character, but disgraceful in the extreme to the administration."

Before Buchanan was elected to the legislature, his father was doubtful of the advisability of his entering politics, urging that it was better "to be an eminent lawyer than to be part lawyer and part politician." Buchanan disregarded this advice, and he soon became an eminent politician rather than part lawyer

and part politician. Besides serving in the state legislature, he was a member of both houses of Congress, where he was a strong supporter of Jackson; was minister to Russia, in which capacity he negotiated our first commercial treaty with that country; was minister to England; and was secretary of state under President Polk. In this last position he had a part in the negotiations by which we secured the southern half of the Oregon country, and the vast territory in the southwest from Mexico. He was heartily in favor of the annexation of Texas, and this, together with his share in the Ostend Manifesto, in which he favored the acquisition of Cuba, led to the charge that he was a pro-slavery man.

How He Got to be President

Fortunately for his future political career, he was serving as minister to England at the time of the passage of the Kansas-Nebraska Act, and so was not involved in the quarrels over that bill. This made him an available candidate for the Democratic nomination for the presidency in 1856. Combined with his national reputation as a statesman, it made certain his election over Fremont, the Republican candidate.

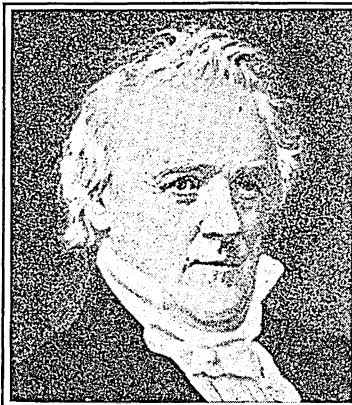
Buchanan was nearly 66 at the time of his inauguration—the oldest president, except William Henry Harrison, that the country has had. And at this advanced age he was called upon to face some of the most serious problems which have ever confronted a ruler. It is no wonder if at his age he attempted, in a feeble way, to avert—instead of meeting—the conflict which threatened the country.

Civil war was already raging in Kansas, where slave-state and free-state men strove to secure possession of the state government. Buchanan was impressed by the threats of secession uttered by fire-eating Southerners, and urged Congress to admit Kansas under the Lecompton constitution, which allowed slavery. He declared that Kansas was as much a slave state as was South Carolina or Georgia; but Congress did not agree with him, and consequently Kansas for the time was kept out of the Union.

Thus the rift between the slavery and the no-slavery forces was widened, and the danger of secession became more threatening. The hope that the Kansas dispute might be taken out of politics and settled by judicial decision had proved vain, for

nearly the whole North had denounced and repudiated the decision of the Supreme Court in the Dred Scott case (see Dred Scott Decision).

These questions were serious, and Buchanan's handling of them failed to satisfy the North. But they were insignificant when compared with the crisis of 1860, between the election and the inauguration of Abraham Lincoln, as a Republican President on a platform opposed to slavery extension. President Buchanan's efforts to please both sides were even more pitiable at this time than before. He declared on the one hand that a state had no right to withdraw from the Union; but in the same message to Congress he said that there was no way to prevent a state from seceding if it wanted to, for the constitution did not give the national government the right to make war on a state. His acts were as contradictory as his words. At first he did nothing to uphold the Union. He had followed for so long the dictates of the Southern leaders that he lacked the courage to oppose them in this critical time. After the resignation of the Southern members of his cabinet, he was induced to send a steamship to Charleston, S.C., with supplies for Major Anderson at Fort Sumter. But the expedition was not allowed to land, and Buchanan made no other attempt to relieve the fort—leaving it to Lincoln, the incoming President, to manage the situation. War supplies were allowed unchecked to fall into the hands of the seceding states. Buchanan blamed the Republicans of the North for the war, because they refused to abide by the Dred Scott Decision and to



JAMES BUCHANAN

BUCHANAN'S ADMINISTRATION (1857-61)

- Dred Scott decision (1857).
- First Atlantic cable laid (1857).
- Lincoln and Douglas debates (1858)
- Oil discovered in Pennsylvania (1859).
- John Brown's raid on Harper's Ferry (1859).
- Minnesota, Oregon, and Kansas admitted as States (1858, 1859, 1861).
- South Carolina secedes (December, 1860).
- Other Southern States secede and form the Confederacy (1861).

enforce the Fugitive Slave Law. Also, he was anxious that it could not be said that war between the states had been started by a Democratic President.

Buchanan's policy was generally condemned in the North, and he was called "the most perfect imbecile that ever held office." It is no wonder that he said to Lincoln on March 4, 1861, "If you are as happy to come into the White House as I am to leave it, this is certainly the happiest day of your life."

This was the end of Buchanan's public career. He retired to his farm near Lancaster, Pa., where he died seven years later. He is the only President who lived and died unmarried. His last years were spent in trying to justify his actions while president, the books embodying his defense bearing the title, 'Mr.

Buchanan's Administration on the Eve of the Rebellion'. Though he upheld Lincoln and claimed that the war had been forced on the North by South Carolina and the Secessionists, he still maintained that as President he could not have acted otherwise than he did. No one today approves of the charge that Buchanan was "a traitor to his country," which was made before he retired from office; nevertheless he is still regarded as probably the least successful president that the country has ever had.

BUCHAREST, RUMANIA. "The City of Joy" is, according to a legend, the meaning of the name of this Rumanian capital, which is situated about 30 miles north of the Danube River. Rumanians call it *Bucuresti*. As a main gateway between Europe and the Near East, it is a cosmopolitan and colorful city. Its open-air markets are piled with gipsy wares and produce from near-by farms, and along its boulevards rise some striking skyscrapers and modern apartments.

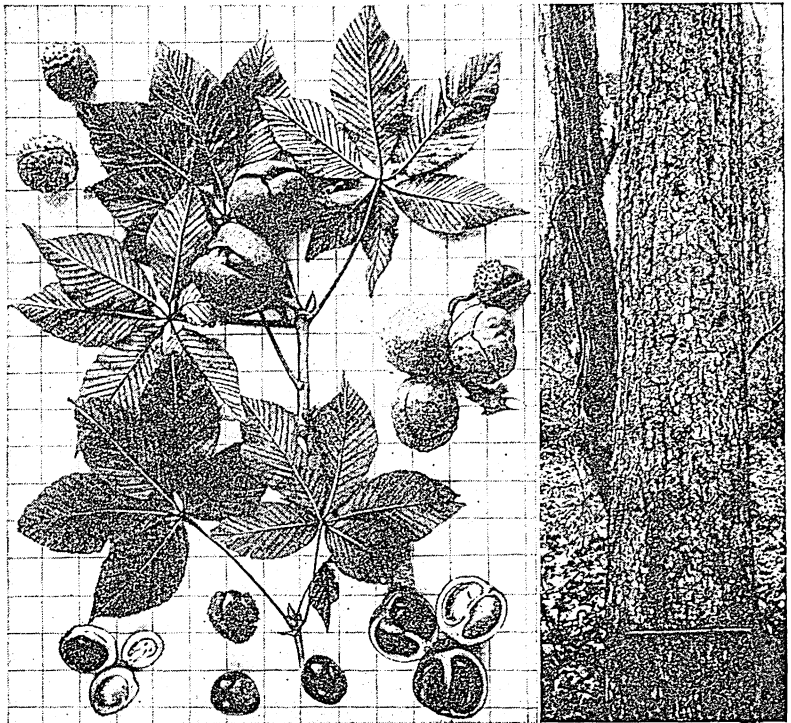
Above the city's magnificent public gardens tower metal-covered turrets and gilded cupolas. Along some streets there still stand quaint old one-story houses covered with plaster and ornamented with brilliant oriental figures. In these sections, too, are to be seen the gay colorful costumes of the Rumanian peasants, and East and West meet on the streets of the city. Oriental costumes and customs are frequently met with, although on the whole Bucharest has adopted Western civilization. Its streets are broad, well paved and lighted, and traversed by numerous electric cars. Manufactures are still in their infancy, but Bucharest is a busy commercial city. As the trade-center of Rumania it exports petroleum, cereals, timber, hides, and honey. Schools are numerous in the city and the University of Bucharest is regarded as one of the best in eastern Europe. It is free to all students.

Disaster has blackened the annals of Bucharest since the city's founding, probably in the 14th century. It was dominated by the Turks during much of its history. In 1862 it became the capital of the newly formed kingdom of Rumania. In the 18th and early 19th centuries plagues took many lives. Earthquakes are frequent, and in 1940 the city and its environs were shaken by a series of destructive shocks.

From 1916 to 1918, during the World War, and again in 1940, during a new European war, Bucharest was occupied by Germany. Both times there were scenes of disorder and violence. Population, about 650,000.

BUCKEYE. So handsome and rapid of growth is the buckeye tree that in spite of a very disagreeable odor exhaled by the bark and leaves, it has been adopted as an ornamental shade tree in all sections where it will grow. The trees are unusually tall, with slender

THE TREE THAT NICKNAMED OHIO



At the right is the straight trunk of the Buckeye or American horse-chestnut. You can recognize these trees by the hand-shaped cluster of leaves, but still better by the smooth brown seeds in their round cases. These seeds may appear to be good to eat, but they are really bitter and mildly poisonous.

branches, and the broad five-fingered leaves grow in umbrella-like clusters, covering the tree with dark luxuriant foliage. Throughout the year the buckeye is a favorite with children. In the spring the snowy white and yellow flower clusters are a source of delight and in the summer they play in the tree's cool shade. In the autumn they gather up the glossy brown "buckeyes" as they drop from the prickly burrs; and in winter the large buds, folded away in capes of polished brown, hold a promise of spring's return.

The wood of the buckeye has been found excellent for making artificial limbs, and quantities of it are used for paper pulp. The country people make soap from the sap, and from the nuts is manufactured a flour which is used to make shoemaker's and book-binder's paste. The nuts are extremely bitter, if not poisonous. Ohio has been called the Buckeye State from the prevalence there of the common buckeye.

In the Alleghenies, as far south as Georgia, grows a species of the tree called the sweet or yellow buckeye. This lacks some of the disagreeable odor of the more common Ohio type, and the fruit is eaten by cattle. The flowers are yellow and showy. A red-flowered

buckeye of small size grows wild in certain parts of the southern states. The English buckeye, which has been transplanted to this country, is often called by us the "horse-chestnut." It is a very large tree and has big clusters of white, pale yellow, or pink flowers. The wood is soft and pulpy and has no commercial value. Japan also has a species of its own, and yet another species grows on the Himalaya Mountains. The name "buckeye" is probably derived from the likeness which the smooth brown nut, with its light brown spot, presents to the eyes of a deer.

Scientific name of the common buckeye, *Aesculus glabra*. Flowers pale yellow, growing on short pedicels in close panicles. Leaves palmately compound, opposite and sharply serrate. Bark dark brown, separating into thin pieces.

BUCKWHEAT. When the first frosty days of autumn come, how delicious are the fresh buckwheat cakes, dripping with golden maple syrup and flanked with spicy sausages!

The buckwheat flour with which the cakes are made comes from the seed of the buckwheat plant, which is a native of Asia, but cultivated in most countries and to quite a large extent in the United States. Its name comes from the German word *Buchweizen*, meaning beechwheat, so called because of the resemblance of the three-sided grain or seed to the nut of the beech tree.

Buckwheat is cultivated in China and other eastern countries as a food plant, but in Europe it is used principally as stock and poultry food, although in France a dark heavy bread is made from buckwheat flour, and in Germany and Poland a buckwheat gruel is sometimes eaten. Buckwheat meal is baked into cookies as a dainty for Dutch children, and in the Russian army buckwheat groats are given out as part of the soldiers' rations, and are cooked with butter or tallow. The flowers of the plant are rich with honey, and buckwheat is sometimes grown by bee farmers. Buckwheat honey is dark and has a characteristic flavor very pleasing to many people.

About two-thirds of the buckwheat crop of the United States is grown in New York and Pennsylvania. Ohio, West Virginia, Virginia, Michigan, Minnesota, and Wisconsin produce most of the remainder. Light well-drained soils are best suited to its production, but the plant is very hardy and grows well on poor soil with little cultivation. For this reason it has been called the poor farmer's crop, and the term "buckwheaters" is sometimes applied to unskilled farmers. It grows so quickly that it can be sown in midsummer and yet ripen before frost.

Scientific name, *Fagopyrum esculentum*. The plant has smooth branching stems, one to three feet high, green leaves with dark veins, and clusters of pale reddish flowers.

BUDAPEST, HUNGARY. Few capitals of the world typify the life of the country as Budapest typifies the life of Hungary. As Paris is sometimes said to be France, Budapest may with even greater truth be said to be Hungary. In it centers the political, commercial, industrial, and intellectual life of the country, and its

population reflects the various racial elements of the nation.

Situated on the banks of the Danube River, just where that stream makes a sharp bend to the south, the city is made up of the two old towns, Buda and Pest. The first was founded by the Romans in the 2d century A.D.; they, however, called the place *Aquincum* from the old Celtic name meaning "rich waters," which referred to the numerous mineral springs in the surrounding region. It was the Huns under Attila, in the 5th century, who, at the time of their settlement in the plains of the Danube, revived the names Buda and Pest, the meanings of which are uncertain. The former, on the right bank of the river, today straggles over a series of small steep hills, while Pest occupies the low flat plain on the left bank.

In the old section of the city (Buda) are the royal castle, the government offices, and the homes of the old Magyar or Hungarian families. The newer town of Pest is, on the other hand, the commercial and industrial center of the city. In it are some of the largest electric works in Europe, in which were planned the first successful underground trolley lines. Large flour-milling establishments are there, and factories for the making of machinery, chemicals, carriages, and cutlery. From its warehouses are shipped by rail or by the Danube the exports of the country—grain, wines, wool, cattle, and flour. It is believed that Pest has always been an industrial center, for the name is the Russian word for "oven" and probably refers to the great lime kilns which were formerly an important feature of the place.

In Pest, too, is located the University of Hungary, which has been so successful in its efforts to foster the language and literature of the Magyars or native Hungarians.

The progress of Budapest dates entirely from the 19th century. The union of the two towns, in 1873, did much to aid the cause of civic improvement, especially in the removal of slums and the reconstruction of the two towns. Population likewise increased rapidly. At the beginning of that century the two towns contained about 54,000 people. Before the World War of 1914-18 the population was 880,000, of whom nearly 600,000 were Magyars and 110,000 Germans, with the remainder a mixture of the Balkan races. Present population, over 1,000,000.

Although Budapest was affected by disorders incident to the revolutions of 1918, it did not suffer as did some other cities. Even when the Bolsheviks, under Bela Kun, gained possession of the city, progress in civic improvements continued.

BUDDHA (about 568-488 B.C.). More than 500 years before Christ was born—and at about the same time when Confucius was founding the religion of the Chinese—a Hindu prince named Siddhartha Gotama became so famed in far-off India for his holiness and tender-hearted love for all creatures that he was called "the Buddha," or "the Enlightened One."

Many persons believed in his teachings while he lived. After his death temples were built in his honor and his religion spread through a great part of Asia.

What the Great Teacher Found under the Bo Tree

It would seem as if this young prince had at his command everything that his heart could wish—wealth

and power, health and beauty, and a wife and young son whom he dearly loved. But his mind constantly turned from the pleasures and empty life of the court to the mysteries of life and death, of suffering and sin and sorrow. At length, at the age of 29, he fled from home and became a beggar. Through all sorts of penances inflicted upon his body he sought to free himself from evil and attain unto holiness.

The solution—that ignorance is the source of all evil and of all desire—came to him while meditating in solitude under the bo tree, which the Buddhists call the tree of wisdom. Different religions and peoples throughout history have had traditions of such “enlightened ones” or inspired leaders. It should also be said that this state of enlightenment, of finding oneself free from worldly sin, was the aim of the medieval monks, as it is today of the various kinds of fakirs (fah-keers) or ascetics that swarm in India and the rest of the Orient—who fast and perform useless penances, even when they are not (as many are) cunning imposters who live off the superstitious ignorant people.

When he had attained unto Enlightenment, Buddha cut off his hair and for 40 years preached up and down the valley of the Ganges. He found his fellow Hindus and their priests, the Brahmins, living worthless lives and not according to the Vedas or sacred books. Buddha taught that the three great sins are self-indulgence, ill will, and ignorance, and that by freeing oneself from all desire one gained a blissful state of abandonment of self called “Nirvana.” He died about 488 B.C. near Benares, when 80 years old.

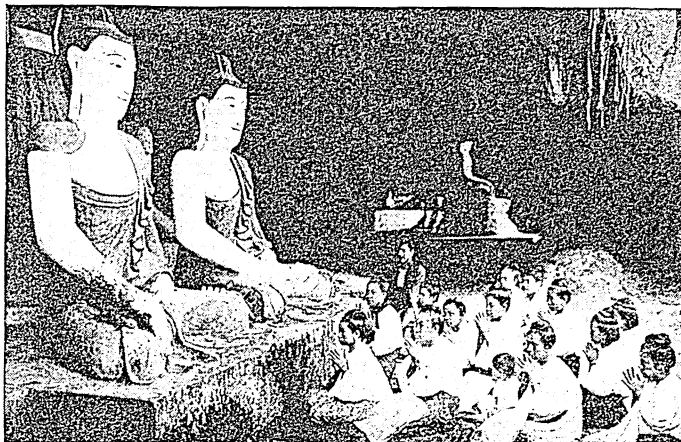
The Strange Doctrine of Transmigration

The followers of Buddha have a vast literature in the ancient language Pali, which records Buddha's discourses and conversations with his disciples. In recent times archeologists have dug up in India and deciphered many memorials of his life, one of them being a casket which contained a bone of the Buddha. His religion appeals to the oriental mind with its teaching that existence is in itself evil, and that the

soul lives over and over again on earth—first in one person and then in another, at times even as an animal, insect, or plant—rising higher in the scale after each good life, and sinking lower with each evil one. For this reason Buddhists never kill animals or take life of any sort. As in their rival religion

Jainism, which is closely akin, all space about the temples or pagodas is cleared of vegetation lest one should unknowingly tread upon some insect, such as an ant, which is the habitation of a soul. In India the Jains, a rich sect, go to the extent of supporting hospitals for injured or sick animals, which they buy and keep under their protection, and even hire poor natives to lie on beds that are infested with vermin, so the vermin can feed!

TEMPLE OF BUDDHA IN A CAVE



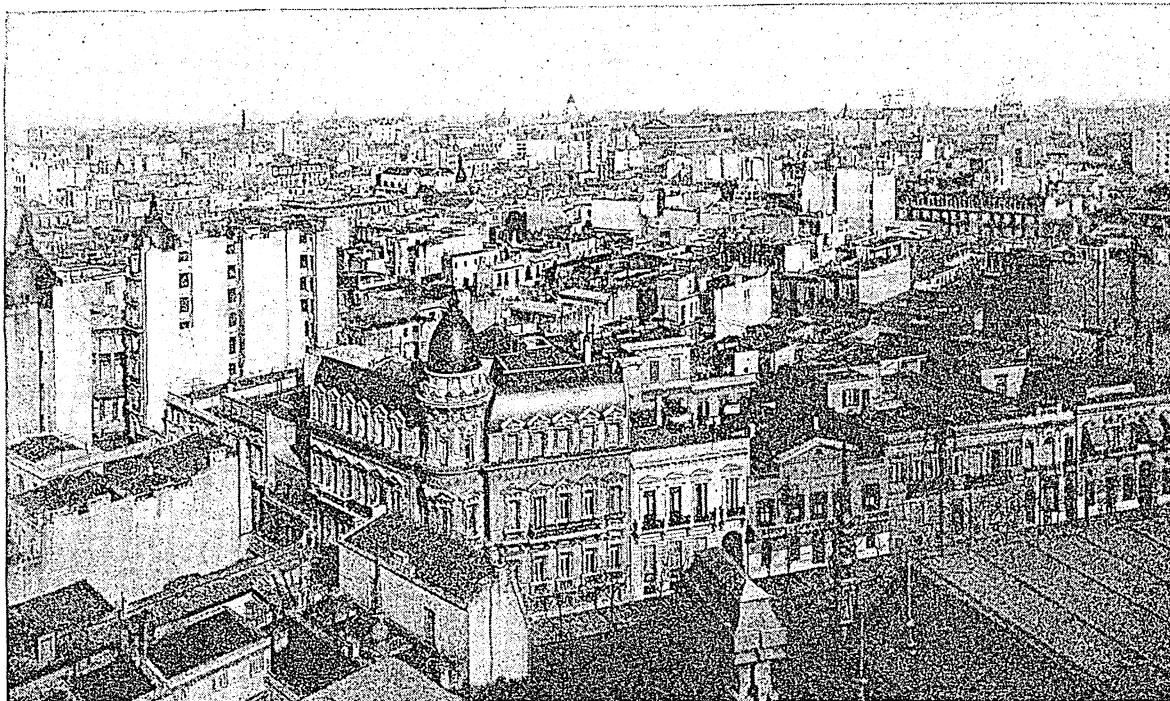
The Bingyi Caves, about 50 miles from Maulmain in Burma, are favorite resorts of Buddhist worshippers. Here we see a group of Burmese women praying before two statues of Gotama Buddha. These are examples of the marvelous underground temples which are found in India.

Buddhism preaches kindness to all living things and persons. There is no God in Buddhism, no Creator. There is no beginning and so no end, or, if there is an end, it is in nothingness or “Nirvana.” Thus there is no hope of a heaven. We may profitably compare Buddhism with the religion of the Greeks, who represent the thinking West that prepared the way for Christianity. The Buddhists stand for self-repression, suppressing all one thinks or wants to do. The Greeks stood for self-expression, for action, and changing what is bad into the good.

India is no longer the chief numerical center of Buddhism, but pilgrims come as in ancient times from all parts of the Orient to visit the places sacred to Buddha. The religion, as practiced today, has become degraded and idolatrous, and its monks, as in Tibet, are often worthless imposters who live off the superstitious people. Its purest and most important home is in Ceylon. Altogether there are over a hundred and fifty million Buddhists in the world, chiefly in China, so that this belief still ranks as one of the great historic religions of mankind.

BUENOS AIRES (*bwā'nōs ī'rās*), ARGENTINA. If you follow the golden highways of the world's commerce, you will find yourself before long sailing up the wide mouth of the Rio de la Plata, from the east coast of South America, and docking 165 miles from the sea in the harbor of Buenos Aires, the capital of the Republic of Argentina, and one of the wonder cities of the world. Around you will be moored or anchored scores of steamers, flying the flags of all nations. And spread out on the south bank of the river, more than

THE WONDER CITY OF SOUTH AMERICA



Buenos Aires, capital of Argentina, is one of the newest of the great cities of the world. In half a century it grew from a straggling cattle town to be the third largest city on the American continents. Unbounded wealth pours into it as a result of its vast commerce. Here is a general view of the older and more crowded residence district, which might easily be taken for a section of Paris or some metropolis of the United States.

30 miles broad at this point, you will see a great modern metropolis, 16 miles long and 12 miles wide, where a few decades ago there was only an old-fashioned unpaved cattle town.

Buenos Aires today is the largest city in the southern hemisphere, and the third largest on the American continents, ranking ahead of Philadelphia. Wealth and progress are the results here of the busy commercial spirit of the New World. The vast harbor system, constructed at a cost of \$50,000,000, has opened the shallow river channels to the largest ships. Huge warehouses line the six miles of wharves, including the "Central Fruit Market," the largest warehouse in the world, occupying an area equal to nine New York City blocks. Through these storehouses pass more foreign goods than any other American gateway outside of New York City.

Beyond the wharves lies the city in all the magnificence of imposing new buildings, broad streets, beautiful parks, and handsomesquares. The thoroughfares are alive with automobiles, street-cars, trucks, and all the signs of thriving industry. On the sidewalks before the glittering shop windows every language of the globe may be heard. On the news stands, beside papers in Spanish, will be found publications in English, French, Italian, Scandinavian, Russian, Hebrew, and Arabic. Indeed, the newspapers of Buenos Aires, as much as anything else, are gauges of the city's progress. The two largest, *La Nacion* and *La Prensa*, have fine cable services to cover the news of the

world; and *La Prensa* is a most unusual institution. Its handsome building is dedicated to social service, and contains a library, free evening schools in commerce and music, offices for free medical treatment, free legal aid, and free chemical laboratory, etc.

A rapidly extending subway system burrows beneath the business district. The water system and sewers, built at a cost of \$45,000,000, are unexcelled; with other sanitary measures they have rid the city completely of its former cholera and yellow fever.

Buenos Aires has many fine schools and technical colleges, and an excellent university with more than 10,000 students. The people are great lovers of drama and of music, and each year some of the greatest singers and actors in the world appear in the numerous and gorgeous theaters.

The great Plaza de Mayo is the center of the official life of the city. Here are the Casa Rosada (the Pink House) where the president of the republic lives, the 18th century cathedral of classic design, the National Bank of Argentina, and the immense House of Congress, built in 1906 at a cost of \$6,000,000.

Buenos Aires draws its wealth from the vast cattle and farming lands of Argentina, and it is the central point for the country's extensive network of railways. The city contains almost one-fifth of the population of the republic. Its mayor is appointed by the president, and so has the power of the federal government behind him. This commercial and political centralization has brought prosperity and at-

tracted foreign immigration and capital to the city, and it promises to maintain Buenos Aires as one of the most important trade centers of the world. Population, about 2,325,000.

BUFFALO. The true buffaloes—which must be carefully distinguished from the American “buffalo” or bison—are natives of India and most parts of Africa except the north. The Indian buffalo is still to be found in wild herds, though as a rule it is domesticated. This animal is larger and more powerful than the ox, and because of its great strength and its ability to labor in water-covered ground, its services are very highly valued. It is a most interesting sight to see this huge creature at work in the rice fields, with its head held low and its nose thrust forward, steadily pulling a cultivator through the flooded muck. The water-buffalo or “carabao” of the Philippines is a domesticated variety of this species.

The Cape buffalo of south and central Africa is of the same powerful bulk as the Indian buffalo. Instead of long horns curving outward and backward, the Cape buffalo has short flat horns so thickened at the base as to form a helmet-like mass which makes the forehead almost invulnerable. The ear is larger and the head shorter than that of the Asiatic animal. Both have ashy-black hides, sparsely hair covered, which are valued for their toughness. The fierce, cunning Cape buffalo has never been domesticated and is considered one of the most dangerous jungle beasts. Like its Indian cousin, it is fond of water and frequents reedy swamps in large herds to feed on aquatic plants. The faithful buffalo bird attends it everywhere, picking ticks from its hide and warning it of danger. A dwarf red buffalo frequents the Congo region.

A sturdy dwarf buffalo of Mindanao, P.I., is the timarau. The anoa of Celebes, a little over three feet high, is the smallest of wild cattle. (See Bison.)

Buffaloes belong to the family *Bovidae* of the order *Artiodactyla*. Scientific name of the Indian buffalo, *Bubalis bubalis*; of a larger Indian form, *Bubalis arni*; of the Cape buffalo, *Bubalis caffer*; of the Congo buffalo, *Bubalis nanus*; of the anoa, *Anoa depressicornis*.

BUFFALO, N. Y. The “Queen City of the Lakes” is the second largest city in New York State and the 14th largest in the United States. It is situated at the

inlet of Lake Erie into the Niagara River, at the eastern end of the lake. The city has about 37 miles of water frontage. It is 24 miles south of Niagara Falls.

The city’s position on the Great Lakes, together with other transportation advantages, gives Buffalo its rank as a world port in the volume and variety

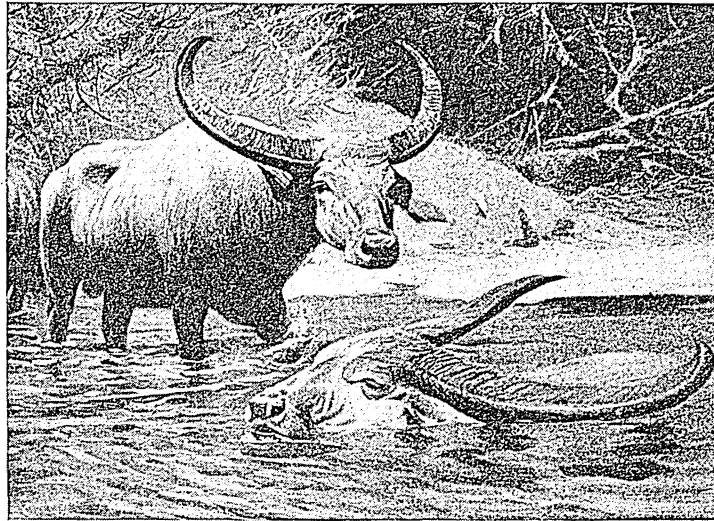
of its shipping. The Welland Canal, 20 miles west, gives Buffalo a water route to the St. Lawrence River, and the New York State Barge Canal (Erie Canal) makes a continuous waterway from Buffalo to the Hudson River. The harbor in the mouth of the Buffalo River, protected by an immense breakwater, is one of the best on the Great Lakes, and a new harbor has also been made by building a breakwater in Niagara River. Two bridges span the river, connecting Buffalo with the Canadian cities of Fort Erie and Bridgeburg, Ontario. The \$4,500,000 bridge to Fort Erie, completed in 1927, is known as the Peace Bridge, to commemorate the hundred years of peace between Canada and the United States.

As a center of railroad transportation, Buffalo is second only to Chicago. Since it is about the same distance from New York, Philadelphia, Baltimore, and Chicago, it handles an enormous amount of freight in shipment and transshipment, especially grain, lumber, coal, and ore. Railroad transportation is its largest single industry.

Nearness to raw materials, and to electric power from Niagara Falls, makes Buffalo a city of diversified manufactures. The key industries are iron and steel, rubber, lumber, grain, and chemicals. Other important products are soap, linseed oil, dyes and other coal-tar products, leather, clothing, cereals, furniture, railroad cars, airplanes, parachutes, and automobiles from assembly plants. It is also a large meat-packing center and live-stock market, and has taken first place from Minneapolis in flour milling.

The city is a pleasant place of residence, with beautiful parks and drives. Overlooking the lake at the mouth of the Niagara River is “The Front,” a park situated on a bold bluff 60 feet high. A beautiful marble shaft in Niagara Square honors the memory of President McKinley, who was shot in Buffalo while attending the Pan-American Exposition in 1901.

THIS ANIMAL HAS A TEMPER



The wild Indian or Water-Buffalo, seen here peacefully bathing, has a very bad temper. A bull Buffalo, which may reach a height of six feet at the shoulder, can sometimes vanquish a tiger and, on occasion, may attack men without provocation. For ages, this buffalo has been tamed. It is employed for farm work and as a draft animal in the Far East, Egypt, western Asia, Hungary, Italy, and Spain. The abundant milk of the cow is made into the semi-fluid butter, *ghee*, of India.

Buffalo is the home of State Teachers College, Canisius College, D'Youville College, and the University of Buffalo, founded in 1846 with Millard Fillmore as chancellor. Notable too are the Buffalo Museum of Science; Grosvenor Library, one of the nation's largest reference libraries; and Albright Art Gallery, famed for its modern sculpture collection.

As a gateway to the west, Buffalo attracted settlers as early as 1803-4. In 1813 the little trade center was burned by the British, but was incorporated as a village in 1816 and as a city in 1832. The choice of Buffalo as terminus of the Erie Canal and later as a key site in railway transportation brought rapid growth. Buffalo has the distinction of being the home of two presidents, Millard Fillmore and Grover Cleveland. Population (1940 census), 575,901.

"BUFFALO BILL" (WILLIAM FREDERICK CODY, 1846-1917). What boy does not know of Buffalo Bill, one of the most noted of America's scouts, and the organizer of the world-famous "Wild West show"? And what boy has not longed to lead the life portrayed in the "Wild West," which was the kind of life led by Cody for years, while he was rendering his valuable services to the country as an Indian fighter? He was the last of the six great scouts of America of the series whose other members are Boone, Crockett, Carson, Bridger, and "Wild Bill."

"Buffalo Bill" was always a frontiersman, and he moved westward with the advancing frontier. Born in Iowa, his father took him to Kansas in early childhood. When the boy was only 11, the elder Cody died after being stabbed for expressing his hatred of slavery. While still in his teens young Cody became known for his daring and horsemanship as one of the riders of the "Pony Express," which carried the mail overland from St. Joseph, Mo., to Sacramento, Calif.—a distance of 1,950 miles—by means of relays of ponies, each rider covering 75 miles a day. In this way Cody gained the knowledge of the plains and of the Indians, which he used to such good advantage, after 1861, as scout for the United States Army. Besides serving in the Civil War, he took part in campaigns against the Sioux and Cheyenne Indians, killing the Cheyenne chief Yellow Hand in single combat, and performing many other notable feats of skill and daring. His name of "Buffalo Bill" was gained in 1867, when he contracted to furnish fresh buffalo meat to the laborers laying the track of the Kansas-Pacific railroad. To do this, it is said, he killed over 4,800 buffaloes that year, his highest record being 69 in one day. (See also *Far West*.)

In the early 80's Cody began collecting some of the spectacular elements of the rapidly vanishing life of the plains. He gathered around him hundreds of cowboys, scouts, and Indians, and organized the celebrated "Wild West" show with which he toured America and Europe for 20 years. The profits of this enterprise were enormous, but "Buffalo Bill" knew nothing of the management of property, and he lost a large part of the money he had accumulated. He

purchased large tracts of land in Nebraska and Wyoming, and founded the village of Cody, Wyo., at the eastern entrance to Yellowstone Park.

The brave old fighter's tomb is such as he would have chosen for himself. His body lies in a vault blasted out of the solid rock on the peak of Lookout Mountain, 20 miles from Denver, Colo.

BUGLE. One of the oldest of musical instruments, the bugle is now chiefly devoted to military use for sounding signals and orders and for playing marches in a drum and bugle corps. The army or navy of every nation has its own system of bugle calls which soldiers and sailors must learn to recognize. The official musical notation of three of the best known United States Army calls follows:

REVEILLE



REPEAT FIRST LINE

TAPS



ASSEMBLY



The infantry bugle is usually keyed in B flat; the smaller cavalry bugle (called "trumpet" by cavalrymen) is keyed in C; the artillery trumpet is still smaller and higher pitched (E flat). The latter has a conical instead of a bell-shaped mouth.

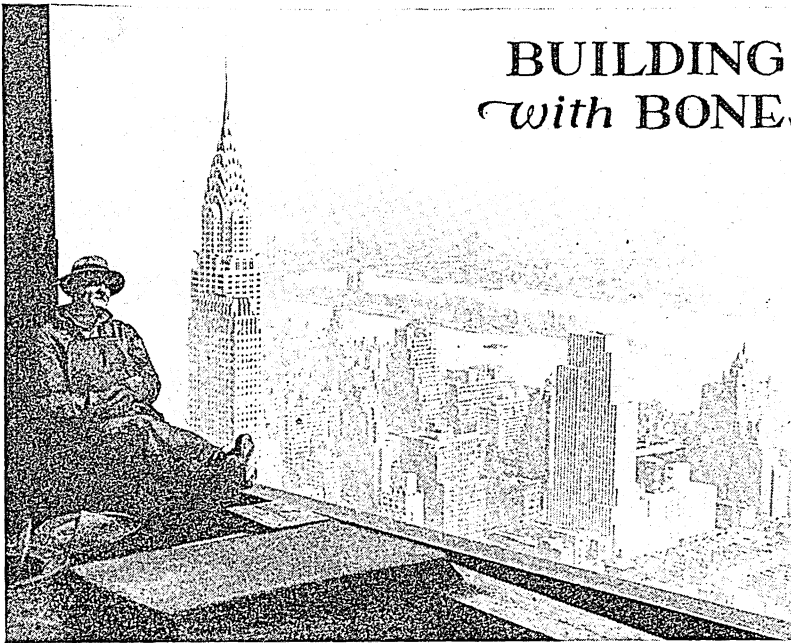
To blow a bugle well requires much practise, not only to master the technique, but also to toughen the lips so that they can withstand the sharp vibrations.

BUILDING AND LOAN ASSOCIATION. When a person with a little money wishes to buy or build a house he may obtain the remainder of the money he needs from a building and loan association. Corporations of this kind are also known in the United States as savings and loan associations, homestead associations, or coöperative banks. They provide capital for building and they furnish a good means for people of moderate income to invest their savings.

Loans are made from the sums invested. Borrowers are required to give the association a first mortgage on their property. They repay the loans gradually in monthly payments which also take care of interest on loans and usually of taxes on the property. Investors may make regular weekly or monthly payments, they may pay in small sums from time to time, or they may invest lump sums. Dividends are paid or compounded semiannually from the association's profits.

Home-financing institutions operate under state or federal charters. In 1934 the Federal Savings and Loan Insurance Corporation was created by the government to insure investments up to \$5,000 in approved associations; that is, in associations considered to be financially sound and properly managed. The first association in the United States was organized in Frankford, Pa., in 1831.

BUILDING GIANTS *with BONES of STEEL*



Resting from his labors during construction of the Empire State Building, this steel worker gazes over New York's man-made peaks. The lofty Chrysler Building rises at the left.

BUILDING CONSTRUCTION. When the pyramids were built the only mechanical helps in moving the great blocks of stone were probably the lever, the roller, and the inclined plane; and the only power was the labor of great numbers of oxen and tens of thousands of slaves, driven by the lash.

Contrast this with the construction of a modern office building in an American city. One week an old building is being torn down to make room for a new skyscraper. Six months later the completed structure towers into the air to a height that makes the buildings of former days seem almost like toys.

An amazing achievement such as this is possible only because of the progress in science, manufacturing, and engineering which has revolutionized the building industry in the last half-century. Structural steel is now made cheaply and rapidly in standardized forms. Hoisting machines, cranes, and derricks swing enormous weights from their powerful arms and drop them deftly in the proper place, so the building may be rapidly assembled. The manufacture of cement has been improved so that unlimited quantities of dependable material are made cheaply. Engineering skill has developed foundations strong enough to carry safely the towering structures of stone and metal. The country has been covered with a network of railroads and roads by which the materials are brought quickly together at the desired time.

Why Skyscrapers are Useful

The need for buildings of such great height is a recent development, due to the rapid growth of the large cities of the United States. With commercial and financial progress, the great seaports and railroad centers grew until they were densely crowded, and

land for building attained a great value. There was an increasing demand for office and store space to accommodate the ever-increasing number of people who carried on their business in those limited areas.

With the old system of construction, it was not practicable to build high structures. The walls supported the entire weight, and to support a building of ten stories or more the walls must be so thick at the base that there was little room left for floor space. The invention of steel-skeleton

construction overcame this difficulty and made it possible to rear towering structures to a height of more than 1,000 feet.

In steel-skeleton building, a framework of steel is thrown up which carries the whole weight of the building, walls and all. The floor beams are riveted to the columns, just as a bridge is riveted together. The beams of each story jut out beyond the columns and bear the weight of the walls of that story. In this way the walls may be kept at a uniform thickness throughout, usually 16 to 18 inches.

Credit for the invention of this method of building has been given to William LeBaron Jenney, who planned the Home Insurance Building, Chicago (1884); but the matter is still in dispute.

The Method of Building

Since the wall for each story is independent of the other wall sections, work can be started on any story where the framework is completed, or at several different levels at the same time. So, as a great skyscraper is flung into the air, one often sees those aerial acrobats called structural iron workers riveting together the framework at the dizzy height of 40 or 60 stories, while below them at various levels other groups of workmen are busy. Masons may be putting in walls at the fourth story, while the framework above and below is still uncovered. Perhaps another group of men is putting in concrete flooring at another level, while on some floors the work may be so far along that the carpenters and steam-fitters are already at work.

So staunch and rigid is the riveted framework of a modern steel building that architects tell us that if it were possible to upset one it would tip over like a box, instead of collapsing like a building of stone or brick. The framework must be strong enough to sustain the

enormous weight of the whole completed structure, and be braced to withstand the wind pressure. The completed structure must also be elastic enough to resist possible side thrusts, such as might come from slight earthquakes or from vibrations caused by machinery within or the passage of trains near by.

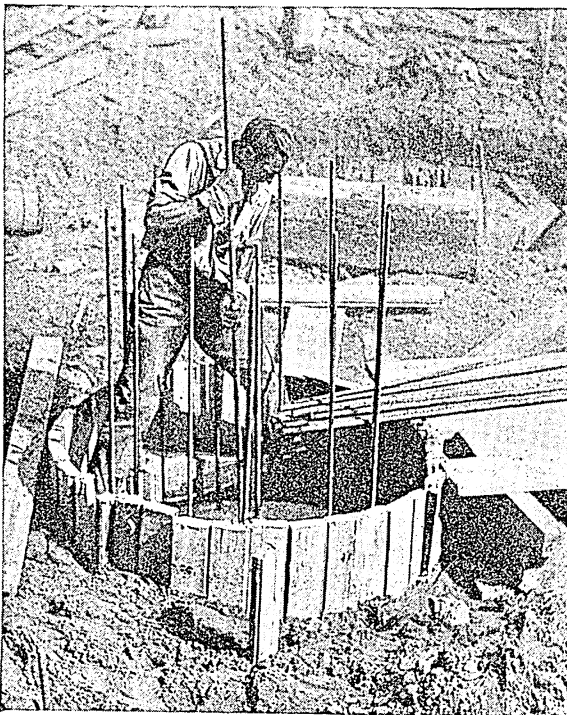
The most important parts of the framework are the columns. These are made of very tough steel which will not break under sudden strains as ordinary steel does. They usually consist of long plates with one or more flanges attached at right angles by riveted angle-plates. They come as a rule in two- or three-story lengths, all ready to be riveted together as soon as they are hoisted into position by great derricks and cranes. All the steel is carefully painted several times to protect it from rust.

Sinking the Foundations

The firmest foundations are pillars of concrete that go clear down to bed-rock. The excavation is made under or in pneumatic caissons under great air pressure, and the caissons are filled with reinforced concrete. Many of the buildings of Chicago, where the soil is soft, rest on a forest of wooden piles driven deep down, or a "platform" foundation. For a platform foundation, an excavation is made covering the entire area of the building. In this is built a bed of iron rails or timbers and cement to support the columns. The general practise today, however, is always to sink caissons to bed-rock.

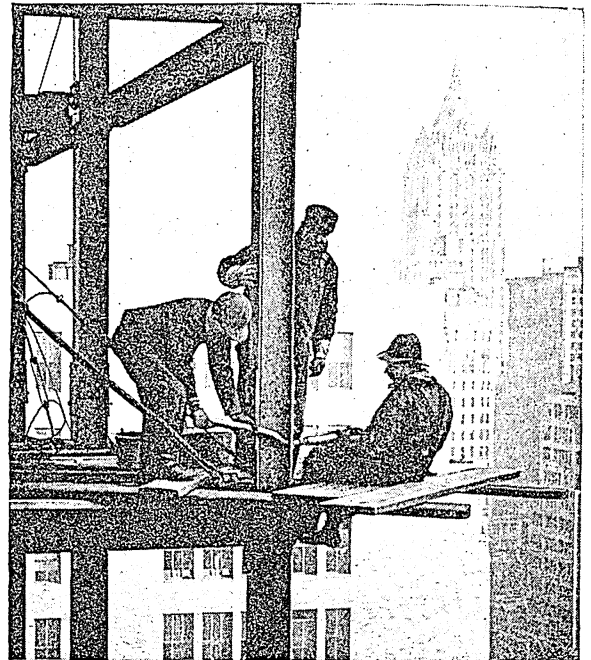
For the walls, cornices, and decorative features stone, brick, concrete, terra cotta, or tile are used,

GETTING DOWN TO BED-ROCK



The caissons, sunk down to bed-rock, are filled with reinforced concrete, each hardening into a stony pillar.

"HIGH STEEL" MEN AT WORK



The riveting crews who "pin" together the huge framework of skyscrapers are the heroes of many a tale of daring.

singly or in combination. Every effort is made to employ fire-proof materials to the greatest practicable extent. The floors are usually constructed of hollow tile arches placed between the floor beams, covered with concrete and surfaced with any desired flooring. For the inside partitions fire-proof hollow tile is often used; a netting of wire fastened to an iron framework at times takes the place of laths. The roofs are often made of "actinolite." This consists of a number of thicknesses of heavy felt imbedded upon a smooth portland cement surface and covered with a roofing cement, on which vitrified tiles are laid.

The Use of Terra Cotta

Architectural terra cotta has been developed to a very large extent in the past few years. This is a hard clay product, nearly fireproof; and it is largely used for interior walls as well as the superstructure. It can be glazed and made in almost any color and shape the architect and builder may desire.

The steel parts are inclosed in non-combustible material, for if one column of steel is twisted out of shape the whole building is in danger. Terra cotta is generally used for this purpose, because of its insulating qualities and light weight. Concrete is also an excellent fire-resisting material, although not proof against intense continued heat.

The recent development in the use of concrete is of no less importance than the invention of the steel-skeleton method. Up to certain heights, reinforced concrete is almost as strong and durable as steel, and it has the added advantage of being far cheaper. By reinforced concrete is meant concrete in which steel rods are imbedded to give added strength to resist

a side pressure or a pull. Since concrete shrinks and expands slightly with extreme changes in temperature, expansion joints to correct this tendency are provided by putting in double columns and double beams separating the entire structure into units.

From the mixing machine the wet concrete is poured into forms of wood or steel, where it is allowed to harden. If no great side stress is to be resisted, no steel reinforcement is necessary, and the concrete is called *massive concrete*. As a rule the supporting frame is left on for two to four weeks, to give the concrete time to harden. (See also Brick and Tile; Cement; Concrete; Iron and Steel.)

The Problem of Building Suitable Residences

An equally important field of construction is the building of residences. Sanitary, soundly-built dwellings are essential to the well-being of a people. To help solve this social and economic problem of adequate shelter, the Federal government in 1937 established the United States Housing Authority. By granting loans to communities, the Authority helped them to demolish slums and build low-rent housing units for people of small incomes.

In 1938 Congress enacted legislation designed to help thousands of people to build their own homes. For many years high labor costs, the requirement of large down payments, and high mortgage rates had made home-building difficult. By the National Housing Act Amendments of 1938, mortgage rates were reduced and down payments cut to as low as 10 per cent.

The cost of building or buying a home is often the largest single investment of a family. Economic experts say that the price should not exceed one and one-half to two and one-half times the family's annual income, with enough additional capital to furnish the house. The subject of building and furnishing a home is so vital that many schools devote extensive courses to it.

Consideration of the site comes first. Transportation is a vital factor, so the nearness to railroad station or to street-car or bus lines may decide whether a site is suitable. The convenience of schools, churches, and stores also should be considered. The noise of near-by

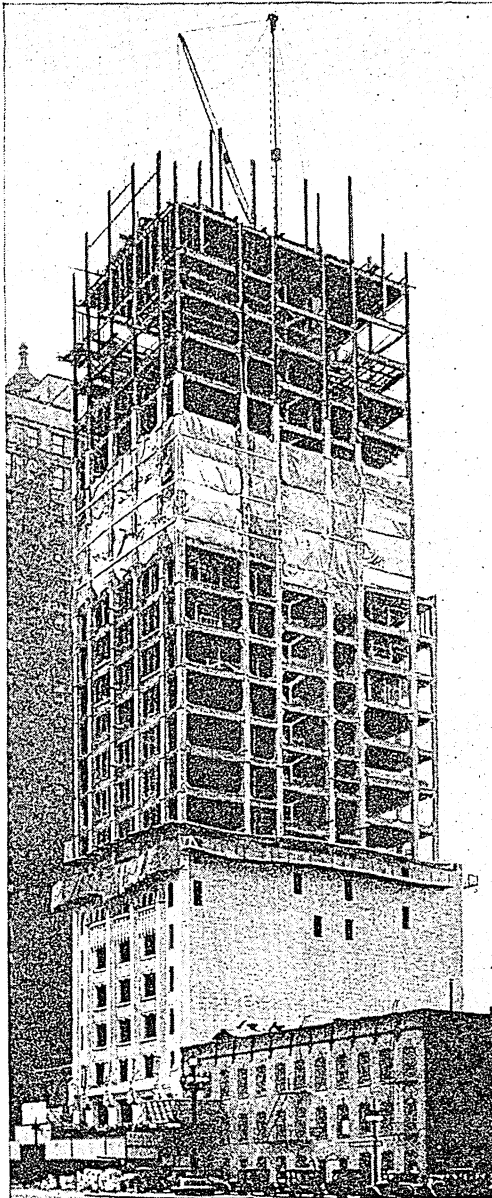
factories or of whistling trains makes many locations undesirable. The family with growing children considers the traffic conditions in the streets, for speeding automobiles in residence sections are a real danger to children. The appearance of neighboring homes should be studied carefully, for well-kept homes usually mean a pleasant neighborhood, while shabby houses mark a district that is on the down grade. In a new suburb, the matter of possible future assessments for alleys, sidewalks, gutters, or sewers should be investigated as well as the tax, water, and fire insurance rates.

The size of the family usually decides the size of the house desired. A two-story home with an area of 700 to 1,000 square feet is ample for a family of four or six, since a floor plan about 24 by 30 feet includes provisions for three bedrooms, bath, and hall; a slightly larger plan, perhaps 26 by 36 feet, allows for four bedrooms. The style of architecture affects the space available within the house. There is a wide variety of choice—Colonial (New England, Southern, or Dutch), Georgian, Norman, Spanish, English, Italian, and others (see Architecture). The architect or builder knows which style is best suited to the required demands, and the United States Department of Commerce issues many helpful pamphlets which cover this subject.

Most houses now are built of fire-resisting materials such as brick, stone, tile, stucco, or

concrete. Sometimes the concrete is poured in frames, sometimes concrete bricks or blocks are used. Stucco is a mixture of concrete, gypsum, and sand. This is thrown up on a surface of lathing and makes a durable

CLOTHING THE GAUNT SKELETON



To the tattoo of steel riveters, one of Chicago's big bird cages mounts skyward. The Mather Tower is seen here in the process of construction, the brick and terra cotta work of the lower stories being filled in while the framework above is still uncompleted. It is a proud day for the workmen when the flag, signaling the driving of the last rivet, is run up.

and cheap surfacing material. Beams and columns for the smallest houses are sometimes made of light weight steel, of concrete reinforced with light steel rods, or of aluminum alloys. Staircases, window and door cases, etc., also are made of steel or of aluminum.

Metal lath in the walls, steel beams, and carefully built chimney flues do much to reduce the fire hazard in frame buildings, and also lower the cost of insurance. Often the walls, floors, and roofs of small homes are made of fire-proof materials.

In building a house, the best grade of materials will prove the cheapest in the end. This applies to everything that goes into the house — foundation, walls, roof, floors, plumbing, heating, and electric wiring. Here again the government helps the home builder by establishing standards of quality which are observed by the best contractors.

The foundation walls should extend at least six inches above the ground, and should reach below the frost line so they do not crack when the ground freezes and then thaws. The drainage system, it should be remembered, must be so arranged as to carry the water away from the house, for water seeping under a basement floor will soon crack the cement and cause a damp basement.

Choice of Roofing Materials

Roofs are made of materials of many sorts. Wood shingles are losing favor because of the danger of fire. Slate, tile, metal, asbestos-cement, and composition shingles of asbestos and felt all have good fire-resisting qualities. Gutters and down spouts to carry rain and melting snow from the roof should be rust-proof, and the drainage should carry the water away from the foundation wall and should not wash away the ground.

The ideal home has plenty of light, air, and running water, with the rooms arranged to give the utmost convenience. The position of the house with respect

to sunlight, winds, and view, is important. Bedrooms should be located to receive the prevailing breezes in summer. Trees on the north side may serve as a windbreak in winter, while trees to the west shut out the hot rays of the afternoon sun.

Windows should cover one-fourth or one-fifth of the floor area to insure sufficient light and air in a

room. For example, a room 12 by 15 (180 square feet), needs from 36 to 45 square feet of window space, divided among two or perhaps three windows. The ventilation and light will be poor if there are not enough windows, but on the other hand, too many windows mean a waste of heat and an unpleasantly glaring interior; and they use wall space that might be used for furniture. Windows should reach close to the ceiling, to keep stagnant air from collecting at the top of the room. They should be weather-tight to save heat, and sills should slope to drain out rain and snow. Bedrooms and kitchens should have windows on two outside walls.

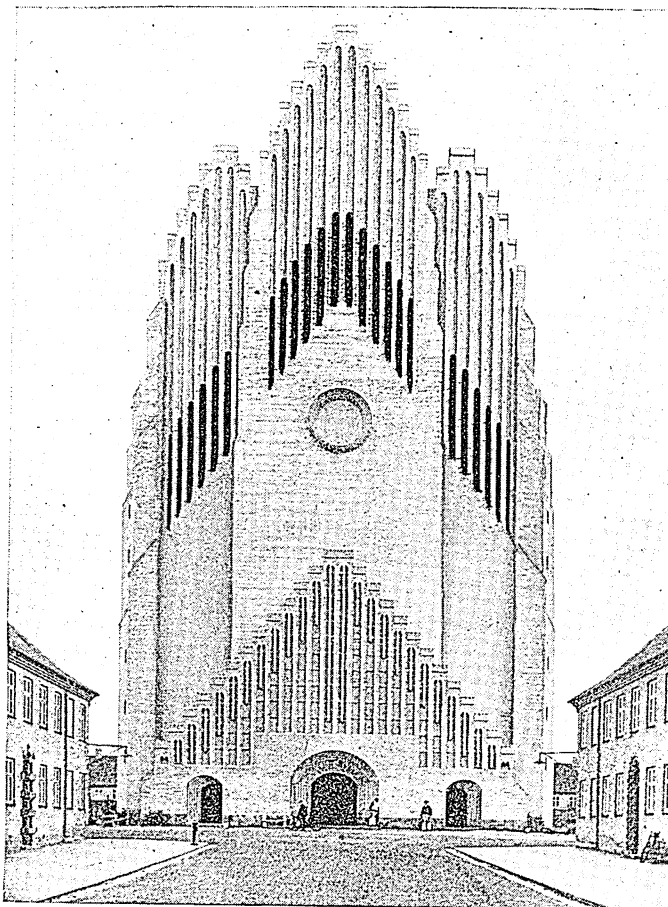
Doors and Closet Space

The number of doors likewise should be limited, because, like windows, they take up valuable wall

space that might much better be occupied by furniture. An outside door should not open into a living-room, and neither should a stairway. A large clothes closet near the entrance door is a convenience and there should be a closet in each bedroom, a general broom or storage closet, and a linen closet easily reached from all the bedrooms. Attic as well as cellar should provide extra storage space.

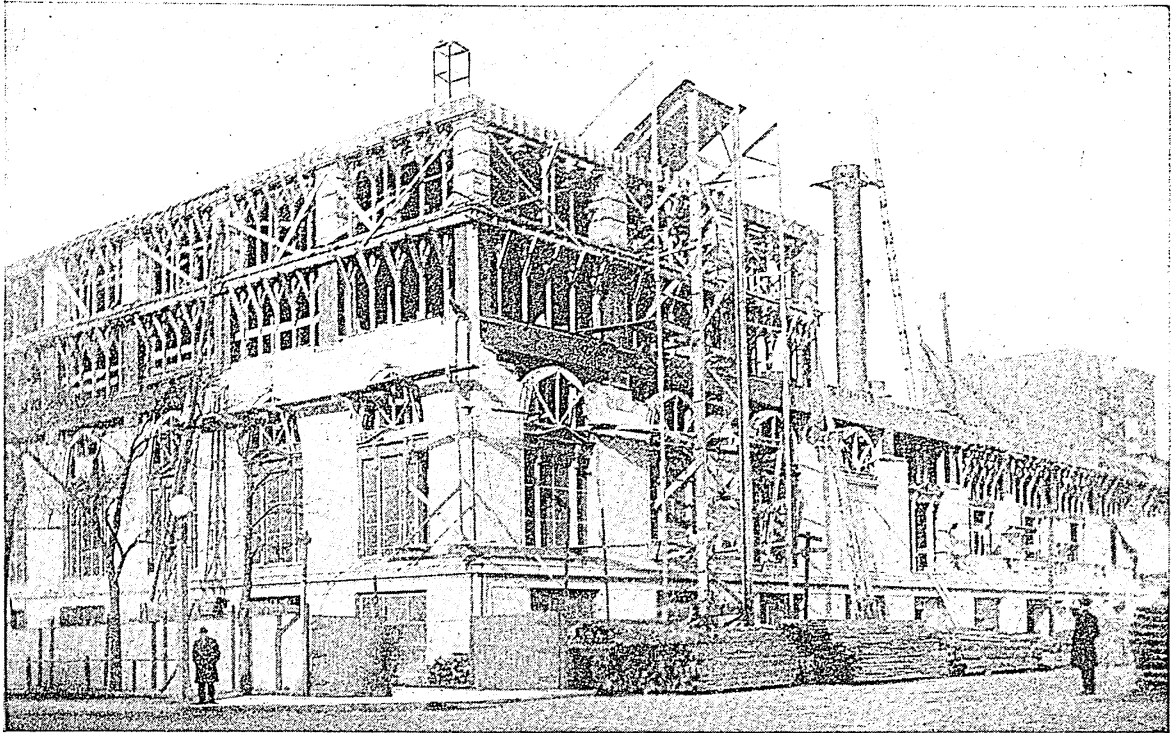
Concrete is a desirable flooring for laundry, porch, or cellar, and tile is popular both for the floor and walls of bathrooms. Art tile also is used as flooring for living-rooms, sometimes with a few scattered rugs. Well-laid linoleum is a serviceable covering for floors of kitchen, pantry, bath, service halls, or other rooms

MASTERLY HANDLING OF BRICK



This façade of the Grundtvig "pipe organ" church in Copenhagen, shows how the most unusual effects can be obtained by using modern methods. The architect wanted to express religious aspiration by means of the severe lines and planes of the "modernistic" style, using brick as the wall material. Such a building would have been impossible a few years ago, but modern methods provide the necessary structural strength.

POURING A WHOLE BUILDING INTO MOLDS



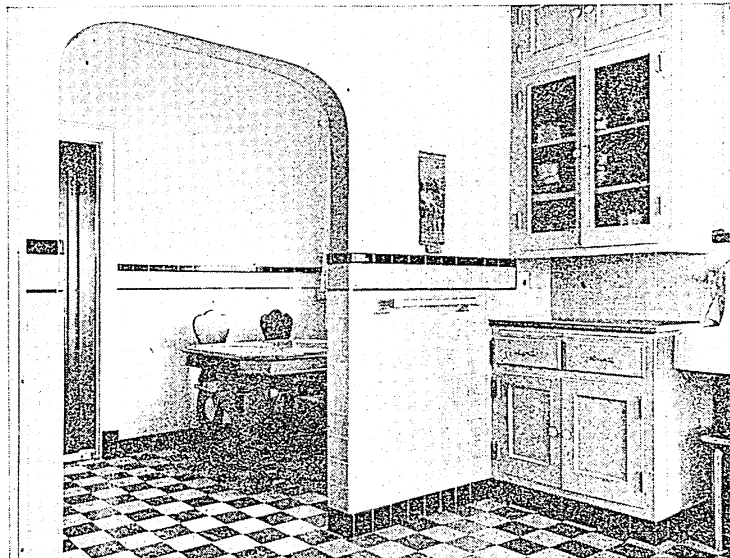
The framework of this building is being constructed of reinforced concrete, and the picture shows the three different stages in the work. On the top story you see the wooden frame molds into which the concrete has been poured and left to set. On the second story are shown the concrete columns after the molds have been removed, but with the supporting braces still in place. In the first story the framework has all been removed and the walls of stone and terra cotta have been put in place. This method of construction is very rapid.

exposed to hard usage. For wood flooring, the hard woods—oak, maple, beech, or birch—are most popular, but excellent service is given by such soft woods as southern yellow pine, Douglas fir, or even western larch or west coast hemlock. The softer woods should be quarter-sawn, else they are likely to sliver. The strips should be narrow, because wide strips tend to expand or contract and require endless filling and painting.

Much of the housewife's labor comes in the kitchen, and modern practise has condensed the old-fashioned kitchen into as small a space as practi-

cable, with stove, sink, tables, and pantry arranged to save as many steps as possible. The greatest wall space with the least floor space is desirable to provide

TRANSFORMATION OF THE MODERN KITCHEN



Tile has become an important building material both for outside and inside finish. The bathroom and often the kitchen of modern apartments and houses are decorated partly or wholly with tile of varying colors and designs. Shown here is a kitchen, with attractive breakfast nook, treated in this up-to-date manner.

room for tables. Window sills should be at least three feet above the floor, to allow a table beneath. Often the pantry is eliminated in favor of cabinets, and the dishes are kept in a cabinet in the dining-room to save steps.

There should be windows on two sides of the kitchen to provide good light and a ventilation that will carry off the odors of cooking.

Perhaps the most valuable contribution made by machinery to

housekeeping is the central heating system, which permits the heat to be controlled with thermostatic devices from the living quarters, avoiding journeys to the basement. (See Heating and Ventilation.)

Planning for Good Light

As the occupants spend most of their time in the living-rooms and dining-rooms, particular care should be given to the lighting arrangements of these rooms. Windows should admit as much sun and air as possible without throwing a glare, and there should be snug corners with reading lamps where one may read with little strain on the eyes (see Lamps and Lighting).

Bedrooms should have easy and inconspicuous access to the bath with windows that afford plenty of air without danger of

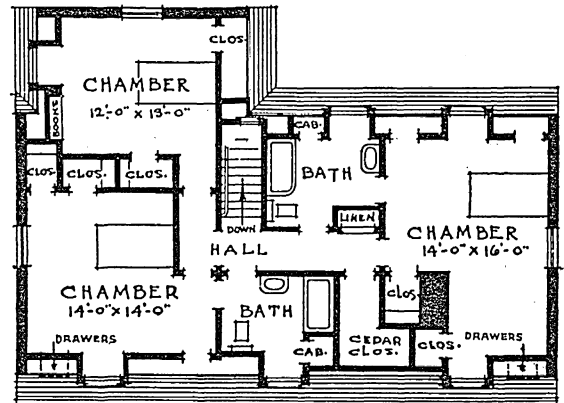
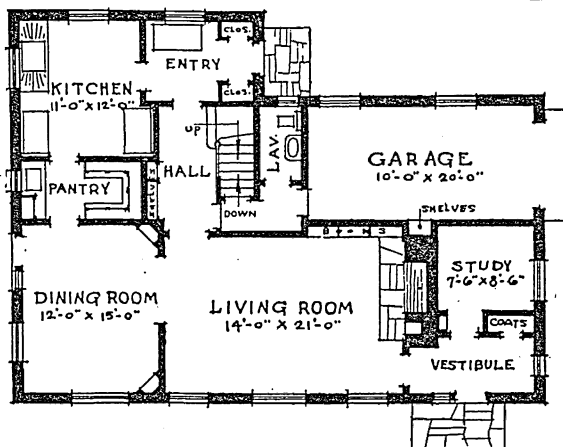
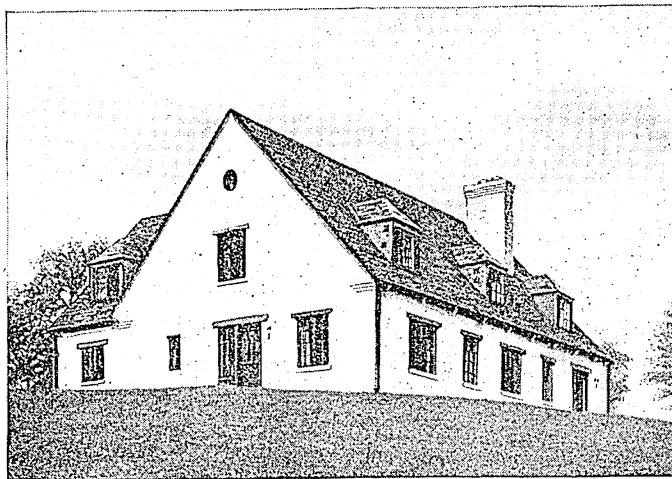
and built-in benches and even tables are seen in the breakfast room. (See also Interior Decoration.)

New Methods to Lower Costs

From time immemorial, a home has always been constructed as a unit of materials shaped on the spot. With the advent of factories, some of the most complicated pieces, such as doors and windows, came to be made in special factories, and the men on the job merely set these pieces of "mill-work" in place. But for the rest, each building was still fabricated largely on the job by hand labor, at constantly rising costs.

Particularly since the World War, architects and engineers have been trying to reduce costs by extending the "mill-work" principle to more of the house—

FITS INTO RURAL SURROUNDINGS



From hundreds of plans for houses of moderate size and cost this one was selected by *House Beautiful* to illustrate the combination of simple and harmonious exterior with convenient inside arrangement. Note how the lines of the house blend in with the hill on which it stands. The architect who made this design was Raymond L. Percival.

drafts. The bathroom especially should have the best equipment the owner can afford, for such improvements as tile floors and walls and built-in tubs eliminate much unpleasant work. Proper insulation of electric wiring in the bathroom is of vital importance; hundreds of deaths and serious injuries are caused every year by electric shocks suffered in bathrooms because of poor insulation. It is equally important to insure fire-proof separation between garage and house if the garage is attached to the house.

Built-in fixtures are found everywhere in the modern house. They are designed to add comfort and convenience, and often to save space. Cabinets are found in kitchens, living-rooms, bathrooms, and bedrooms; built-in bookcases are increasingly popular,

walls, floors, roofs, and the like. Experience has shown that for families of given size and income, there are only a few sizes and shapes of rooms which combine to make the most suitable house, and by combining them differently, all the variety needed can be obtained. By adhering to these standard dimensions, then, much of the house could be bought as "mill-work," and merely assembled.

In keeping with this is the development of new materials, and particularly an extension of the use of metal, not only for framing, but in sheets for surfaces. In fact, some architects predict that the future house will be largely of steel and glass.

A list of terms commonly used in building will be found with the entry Architecture in the Fact-Index.

BULBS, TUBERS, AND ROOTSTOCKS. Among the earliest of the spring flowers which make our gardens and public parks beautiful are the gorgeous tulips, crocuses, and hyacinths, which boldly thrust their leaves above the ground and often burst into splendid blossom before the snows have entirely vanished.

What is the secret which enables these and other flowers to beat their rivals in the race to greet the spring? It is that they grow from bulbs, or bulblike stems, in which food has been stored through the long winter to give to the young plants a quick start over other plants which have to draw their food from the soil as they need it.

Let us see how this food is stored. Cut a tulip bulb in half, or an onion, which is also a bulb. You will see that it is made up of a number of thick fleshy layers, protected by dead tough papery leaves outside. In the center are thick little bud scales, from which the new plants grow. The broad surrounding scale-leaves, as they are called, contain the food for the young plants, held in storage until they need it for their growth and development.

If you look closely at a crocus "bulb," you will see that it is different from the tulip or onion bulb. All the scale-leaves are thin and papery, and the food is stored in the stem itself, which is swollen to a white rounded lump.

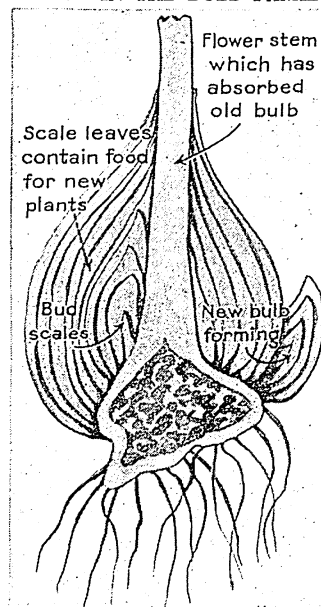
A bulblike stem of this sort is called a corm, and the familiar crocus, as well as many wild plants such as the Jack-in-the-pulpit, is thus provided. Still other plants store food for the coming season's growth in

tubers and rootstocks, which are much thickened underground stems of various forms. You will notice that in the potato, which is our most familiar tuber, the scale-leaves are tiny little things, with the buds in their axils. If you cut off a piece of a potato containing a bud—or eye, as we call it—and plant it in the ground or keep it in a warm place, it will sprout and begin to form a new potato plant. The iris, bloodroot, mandrake, various kinds of grasses, etc., grow from rootstocks or rhizomes, which look like large thick roots, but are really underground stems, because they have scale-leaves.

Plants which have such underground structures enabling them to pass through summer drouth and winter cold, and to develop with great rapidity during the favorable season, are called "geophytes" or geophilous plants. Nearly all the typical spring flowers belong to this class, doing all their growing between the first coming of spring and the

development of the heavy forest foliage which shuts them off from the sun's direct light. (See also Crocus; Onion; Plant Life; Potato; Tulip.)

THRIFT IN THE BULB FAMILY



This picture illustrates how the members of the far-sighted bulb family prepare for the spring flower festival.

A STURDY Nation—Strong in PEACE, Ill-Fated in WAR

BULGARIA. The traveler in Bulgaria must find it hard to believe that this placid country, with its sturdy, healthy peasants, has had so turbulent a history. The one impression Bulgaria gives

above all others is the impression of peace. Yet the country lies in the very heart of the Balkan Peninsula, and it has shared that region's troubled destiny.

Here is a land made up almost entirely of peasants who till their small plots with the care of the gardener and the methods of an earlier century. Modernization has reached the cities, but has been slow in touching the country. Hand sickles, and wooden or iron plows drawn by oxen or water-buffaloes are still widely used. Houses are generally dark structures lighted by oil lamps. Clothes are home spun, home made, and hand embroidered, the style of costume and embroidery varying with the district.

The people are short and stocky, extraordinarily strong, and noted for their longevity. They are hard-

Extent.—East to west, greatest distance, about 270 miles; north to south, about 190 miles. Area, about 42,800 square miles. Population, about 6,400,000.

Natural Features.—Balkan and Rhodope mountains; Danube (forming the greater part of the northern boundary), Maritza, Isker, and Struma rivers. Climate, continental, with wide extremes of temperature.

Products.—Wheat, corn, barley, rye, oats; grapes, sunflower seeds, tobacco, sugar beets, potatoes; attar of roses; raw silk; sheep, cattle, buffaloes, goats, swine; coal.

Cities.—Sofia (capital, 290,000); Plovdiv (Philippopolis) (over 100,000); Varna, Rustchuk (Ruse) (over 50,000).

working, patient, determined, and frugal. Their morals are of a high standard. They adhere to the national church, the Greek Orthodox, but their tolerance of other creeds is marked. A proud

people, they seem to care little what other nations may think of them or of their country's problems. They have a keen passion for education, and the percentage of illiteracy is low. Primary education is free and compulsory. Public libraries are well patronized; high schools and the two universities are crowded.

The country itself is charming, with a variety of climate and scenery, and a rich soil. The Balkan Mountains cross it from east to west, dividing it roughly into two districts. In the northern area cereals are abundantly raised, especially wheat. The southern area is mild, and here are centered those picturesque industries: silkworm breeding, bee keeping, vine culture, and rose growing. There is no more enchanting sight in all Europe than the Kezanlik

COSTUMES AND ARCHITECTURE TELL BULGARIA'S HISTORY



The influence of Finn and Slav shows in the dress of the girl at the left with its rich design and embroidery. The farm scene above is typical of the simple methods of agriculture that still prevail, the farmer's whole family turning out to harvest the crop by hand. Below is the Banya-Bashi Mosque in Sofia, a reminder of the days when Turkey ruled the land.

Valley in June, with its great fields of rose bushes, the lovely scent permeating all the surrounding country. The blossoms are gathered before dawn to preserve the perfume. Attar of roses, into which they are made, is one of the country's principal products. This area also produces tobacco, the chief article of export, fruits of rare quality, potatoes, sugar beets, rice, and cotton. After tobacco the chief exports are eggs, corn, hides, attar of roses, and silkworm cocoons.

Both the Balkans in the central area and the Rhodope Mountain chain in the southwest are heavily wooded and abound in mineral springs. The low undulating Balkans are thinly peopled, though they contain fertile valleys and pasture lands. There are minerals here, notably coal, copper, lead, and zinc, but their exploitation has been limited.

The Bulgarians are descendants of the Bulgars, a Finnish people who settled in this region toward the close of the 7th century. After a time they became completely merged with the Slavs, whom they found settled there, and developed a powerful state which ultimately became a part of the Greek Empire. In the 12th century, after an insurrection, another Bulgarian empire was set up, but it fell a prey to Serbia. In the 14th century the whole region was conquered by Turkey. During the five centuries of Turkish mastery

(1396-1878) the spirit of the Bulgarian people was crushed. A revolt which broke out in 1876 was put down with such cruelty that Russia intervened, glad of the opportunity to make war on Turkey. The victorious Russians dictated a harsh treaty, but the Great Powers of Europe in a conference at Berlin (1878) completely revised it. Bulgaria emerged as an autonomous principality tributary to Turkey. In 1885 the province of Eastern Rumelia was annexed, and in 1908 Bulgaria proclaimed itself an independent kingdom.

The lines drawn by the treaty of Berlin left large numbers of Bulgarians in other lands, especially in Turkey (Macedonia) where there was a strong Bulgarian national spirit. But Serbia and Greece also laid claim to parts of Macedonia and carried on active propaganda there. Macedonian troubles multiplied. Finally the Balkan nations decided the only way to clear up the unrest was in joint action. An alliance was formed, and in 1912 Bulgaria, Serbia, Greece, and Montenegro declared war on Turkey.

Turkey was defeated and forced to surrender almost all its European territory to the allies, Bulgaria receiving the lion's share. Immediately there was trouble over the spoils, and soon Bulgaria was at war with its former allies. This war was disastrous to Bulgaria. Southern Dobruja was lost to Rumania.

Macedonia was divided between Greece and Serbia, Bulgaria retaining only a small salient.

Smarting under this humiliation, Bulgaria entered the World War in 1915 on the side of the Central Powers. It regained southern Dobruja when the Central Powers conquered Rumania. But the Treaty of Neuilly (1919) forced it to return this area to Rumania. It was also compelled to cede certain western districts to Yugoslavia and Western Thrace to Greece. Although an outlet to the Aegean was promised, through the Greek port of Dedeagatch (Alexandroupolis), Greece failed to grant it. (See map, Balkan Peninsula.)

For some years after the World War, Bulgaria was friendless. Its victorious neighbors allied themselves in the Balkan Entente to preserve the territory won from Bulgaria. Then, as Bulgaria grew stronger, it refused to enter the Entente. Instead it established friendship with Turkey, Italy, and Germany. The tie with Italy was strengthened in 1930 by the marriage of King Boris III with the Italian princess Giovanna. After 1935, when a military government was overthrown, King Boris ruled as virtual dictator.

The outbreak of war in Europe in 1939 gave Bulgaria the opportunity to regain some of the territory it had lost, but at the price of German domination. In September 1940 Bulgaria, with the support of Germany and Italy, compelled Rumania to cede southern Dobruja. Six months later, on Mar. 1, 1941, the Bulgarian government formally adhered to the "new order" alliance of fascist nations. The same day German troops were permitted to occupy Sofia and other key cities; and it was from Bulgaria that Germany soon after launched its major attack upon Yugoslavia and Greece. In the wake of German conquest, Bulgaria seized parts of Macedonia and Thrace.

The principal cities are Sofia, the capital; Plovdiv, or Philippopolis, the chief trade center; and Varna and Burgas, the chief ports.

BULL RUN, BATTLE OF. Thirty-five miles from Washington, on a little creek known as Bull Run, the Union and Confederate troops met on Sunday, July 21, 1861, in the first battle of the Civil War. The news of the resulting defeat of the Union troops, as it flashed over the wires the next day, caused the people of the North long to remember that day as "Dark Monday."

The North had expected the conquest of the South to be an easy matter. Troops were enlisted for only three months as it was thought that the war would be over in that time. A mob of volunteers had been gathered at Washington with little idea of what war meant. Officers had tried to make them into an army, but that takes time, and the press and people were impatient. The cry, "On to Richmond," the Confederate capital, had been raised on all sides, and the army command had yielded to the popular demand. On July 16 General McDowell had left Washington with his command, and five days later had met the Confederates near the little village of Manassas on Bull Run. When people in Washington heard

that a battle was being fought, they hurried out to watch it as though on a holiday excursion.

At first the Union troops had seemed successful, but in the afternoon fresh forces joined the Confederates. The Union army was out-numbered and the men became frightened. Some started to retreat and other troops without orders began to leave the field. The retreat soon became a flight. They threw away their knapsacks, their guns, their coats, everything that could impede their progress. The one idea of soldiers and civilians alike seemed to be to get back to Washington and to safety.

The effect on the South of the "battle of Manassas" (as they called it) was to convince them that one of their soldiers was worth half-a-dozen of those of the North, and this conviction was shared by many persons in Europe. The defeat was a great humiliation to the North, but really it was a blessing in disguise. The North learned the bitter truth that the war was not to be a short one, and they began to prepare for it in earnest. Their people and government were determined to wipe out the disgrace suffered at the battle of Bull Run.

BUNKER HILL, BATTLE OF. When General Washington was told that there had been a battle at Bunker Hill he immediately asked: "Did the militia fight?" On being told that they had fought he remarked: "Then the liberties of the country are safe." By that one sentence Washington showed that he realized the importance of the battle of Bunker Hill, the first real battle of the American Revolution.

This famous battle was fought on June 17, 1775, before Washington took command of the army. The colonial forces had been holding the British shut up in Boston, but they learned that the enemy was planning to occupy some of the hills about the city. On the night of June 16, Colonel Prescott and his men started out to prevent this by occupying Bunker Hill, but they changed their plans and fortified Breed's Hill instead.

On the morning of June 17, the British were amazed to see trenches crowning the hill. The vessels in the harbor immediately began bombarding the fortification, and later in the day the British troops attacked it. Twice they advanced to the attack. All was silent as they marched up the hill, for General Putnam had given the command: "Don't fire until you can see the whites of their eyes." When they were within a few yards of the fortifications a sheet of flame swept down from the redoubt. The men in the front ranks were mowed down. The others beat a hasty retreat. A third time the British charged. This time the redoubt remained silent, for the powder of the colonial forces was exhausted. The patriots fought with clubbed muskets, but they were slowly forced to retreat to Bunker Hill, leaving the battlefield in the hands of the British.

It was a victory which had been dearly bought, however, for the British had lost 226 men killed and 828 wounded, while the loss of the Americans had been 145

killed and 304 wounded. Nathanael Greene said, "I wish we could sell them another hill at the same price." Today a granite shaft 221 feet high stands near the spot where the gallant General Warren fell just as the retreat began. The cornerstone of this "Bunker Hill Monument" was laid by Lafayette in 1825, the 50th anniversary of the battle. The monument was dedicated in 1843, with an oration by Daniel Webster.

BUNSEN, ROBERT WILHELM EBERHARD (1811-1899). Our gas-burning stoves, as well as the common blow torch and gas or gasoline lights which use Welsbach mantles, are all monuments to Robert Bunsen, a German chemist. We also owe largely to him the method of spectrum analysis which gives us information about the constitution and the motions of the stars. He was one of the founders of organic chemistry. And at the very outset of his career he discovered that ferric (iron) hydrate is an antidote for arsenic—a remedy which is still standard.

Bunsen was born at Göttingen. His father, a university professor, gave him a thorough education, and in 1836, after discovering his arsenic antidote, he became a teacher of chemistry in Cassel. At that time organic chemistry was in its infancy, and chemists were concerned with the question whether inorganic elements such as metals could be combined with organic compounds. Young Bunsen proved that they could, by six years of brilliant studies devoted to organic compounds of arsenic, now called *cacodyls*. In the course of his investigations, he lost the sight of one eye in an explosion and nearly died of arsenic poisoning.

During the same period he discovered a way to end the tremendous waste of heat that resulted from the methods then used for burning pure illuminating gas (see Bunsen Burner).

In 1841 he began studying electrolysis, with his invention, the Bunsen cell, which contained carbon, zinc, and sulphuric acid. He obtained metallic magnesium, and by burning it produced a brilliant light—a discovery which is now used in the photographic flashlight. To measure the strength of such lights, he invented the grease-spot, or oiled paper, photometer (see Light).

Bunsen became a professor in the University of Heidelberg in 1852. From 1855 to 1863 he and one of his students, H. E. Roscoe, made important studies of

the chemical effects of light. By 1859 he and the university's professor of physics, G. R. Kirchhoff, were winning success in Bunsen's most important contribution to science—organizing the science of spectroscopy, whereby we can learn the chemical character of even the most distant stars (see Spectrum and Spectroscope). With this new method Bunsen discovered the chemical elements caesium and rubidium.

Bunsen invented the filter pump (1868) as well as the ice calorimeter (1870), and the vapor calorimeter (1887)—instruments used in measuring heat.

BUNSEN BURNER. In studying the composition of gases given off by blast furnaces, Robert Bunsen discovered that from 50 to 80 per cent of the heat energy in gas was being lost. He attacked this problem and in 1855 announced a type of gas burner which would save most of this waste heat. This burner bears his name, because it was long thought that he invented it. But Bunsen was not the actual inventor, for the principle was understood and used previously by Peter Desaga and Faraday. Bunsen's contribution was to prove its value to the world.

The principle is used today in laboratories, on all gas cook stoves, and in most gas furnaces. To understand it we must examine the nature of combustion, or burning, in simple flames.

Parts of a Candle Flame

The burning candle illustrated on the opposite page is a good example of a simple flame. Most of the flame is brilliant; but at the base we

see a cuplike bluish zone, and the edge of the flame elsewhere is also bluish. Inside the flame above the wick is a dark cone.

These zones are caused by the course of combustion within the flame, or the union of oxygen with the fuel (see Fire). The fuel in the candle is melted wax or tallow, which consists of hydrocarbons (compounds of carbon and hydrogen). Union with oxygen in the air changes them ultimately into carbon dioxide and water vapor. Complete combustion, as seen at the edges and the base of the flame, produces only a faint bluish light. But there are two stages before combustion is completed.

Just above the wick, the heat changes the fuel to gas. But the gas fills this space, and no oxygen can reach it. Hence the gas cannot burn, and this zone is dark and relatively cool. Then, as the gas works outward, oxygen becomes available and burning



ROBERT WILHELM BUNSEN

starts. It is incomplete, however, and one result is the release of tiny carbon particles from the hydrocarbons. These particles become hot enough to glow, and cause the characteristic yellow light which we see.

At the edges, combustion is completed. Usually some carbon particles remain unburned and pass off as smoke, soot, or lampblack.

We can prove, as Sir Francis Bacon did long ago, that the dark cone inside the candle flame is cool. He thrust the tip of a pointed feather quickly into the center of the cone. Most of the feather took fire immediately, but the tip did not.

How Bunsen Improved Combustion

If we light a jet of gas coming out of a plain pipe, it burns with a bright flame like a candle. But this flame is not very hot. The glowing carbon particles and the soot that escapes represent a waste of fuel. Bunsen's remedy was to mix about three volumes of air with one of gas *before* the gas was ignited. Thus combustion could occur throughout the entire flame.

This is done by bringing the gas in through a small nozzle (*a* in the diagram), which ends inside a larger tube. One or more openings or ports in the larger tube admit air near the tip of the gas nozzle, and the upward rush of gas sucks in the needed air through these ports. A movable collar makes the air ports larger or smaller and so regulates the proportion of air in the mixture. Some burners have regulators in the base.

Parts of a Bunsen Flame

As the mixture of gas and air comes out at the top of the lighted burner, it travels some distance upward before it becomes hot enough to take fire. This is indicated in the diagram by the first inner cone, where the temperature is relatively low (about 660° F.). Around this cone combustion starts violently, producing a second cone of blue flame. Here the carbon in the gases takes oxygen from the air with which the gas is mixed. It will also take oxygen from substances held in the zone. For example, it will take oxygen from copper oxide and reduce it to pure copper. For this reason this zone is called the *reducing cone*. Around its tip is the hottest part of the flame (about 2,700° F.).

In the third or outer cone of the flame, the gas has all the oxygen it needs. Substances heated here unite with any free oxygen that may be available. Hence, this is called the *oxidizing flame*. Its temperature decreases gradually toward the flame's edge.

Only blowtorches and the electric furnace give hot-

ter temperatures than the Bunsen burner; and blowtorches, including those burning gas, gasoline vapor, acetylene, or hydrogen, use the Bunsen principle, with air or pure oxygen supplied under high pressure.

The burner of an ordinary gas stove is supplied with air through ports near the petcock or valve. By closing

these with your fingers you can observe how the flame would burn without its preliminary air supply.

BUNTING. Among the most beautifully colored birds are the plump, stocky little buntings, common throughout Europe and North America. Many of them are fine singers, and all are valued by farmers for the weed seeds they destroy. They build their nests of dried grasses and leaves on the open fields or in low bushes.

The purplish-blue indigo bunting, or indigo bird, is a familiar summer resident of eastern United States. It is about five inches long. All summer long, it sings its canary-like song from some high treetop. The female is brown tinged with blue on wings and tail.

In the southern and western states are the beautiful lazuli, varied, and painted buntings. The painted bunting is brilliantly colored, with bright red under parts, dull red tail and rump, purple head and neck, and yellowish-green back. The lazuli bunting shades from turquoise blue to greenish blue, with brown breast and sides. The varied bunting has a purple head, with back and under parts of plum red.

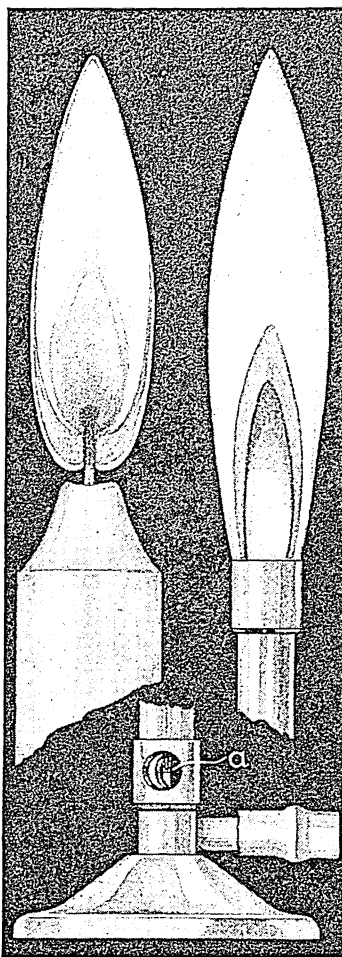
In the central states a modest little bird, with yellow breast and brown and black streaked back, chirps from weed stalks or pasture fences. He is the dickcissel, or black-throated bunting. The lark bunting, which nests on the western plains from Canada to Kansas, is the state bird of Colorado. He is black with white

wing patches and white-barred tail. The white snow bunting of the Arctic winters in southern Canada and eastern United States. The "bay-winged bunting," or vesper sparrow, is not a true bunting (see Sparrow).

In Europe the familiar birds of this group are the corn, ciril, snow, and reed buntings, the yellowhammers, and the ortolans, which are taken in nets for food.

Buntings are members of the large family *Fringillidae* which also includes the finches, sparrows, and grosbeaks. Scientific name of indigo bunting, *Passerina cyanea*; lazuli, *P. amoena*; varied, *P. versicolor*; painted, *P. ciris*; dickcissel, *Spiza americana*; lark bunting, *Calamospiza melanocorys*; snow bunting, *Plectrophenax nivalis nivalis*.

FLAMES COMPARED



Compare the candle flame with that of the Bunsen burner at the right. The text explains why these flames are so different. At the bottom we see the base of a Bunsen burner, with its regulating collar and a gas jet (*a*) inside.

The INSPIRED Tinker Who Wrote 'PILGRIM'S PROGRESS'

BUNYAN, JOHN (1628-1688). More than two and a half centuries ago, a poor tinker "dreamed a dream" in the jail where he spent 12 years of his life for his religious beliefs. This dream he made into 'The Pilgrim's Progress', a story of such universal appeal that it has been translated into more than one hundred languages and still delights both old and young in all parts of the world.

John Bunyan, the author of this world masterpiece, was born in the village of Elstow, near Bedford, in England. He came of an old family that had held land in Bedfordshire as early as 1199, but had not risen in the social scale. His father, Thomas Bunyan, was a tinker, who made and mended pots and kettles. He sometimes worked at the forge beside his own cottage, and sometimes went about the countryside from door to door.

John was brought up to his father's trade, but he was more fortunate than most boys of his class in being able for a short time to attend grammar school in Bedford. He was fond of mischief and of games and sports, particularly playing bowls and tipcat and dancing on the village green—diversions which later his Puritan conscience held sinful. Reckless, high-spirited, and imaginative, he had a ready tongue, which too often found expression in lying and swearing. "Even as a child," he says, "I had few equals in cursing, swearing, lying, and blaspheming the holy name of God." At the same time a strong undercurrent of religious feeling often filled his mind with remorse and terrifying visions.

An Age of Civil War

The period was one of great political and religious strife. Bunyan was born in the year in which the House of Commons extorted from the tyrannical Charles I his signature to the Petition of Right, a landmark in the long struggle between the English people and their kings. He died just before the outbreak of the "glorious revolution of 1688." Between these two dates occurred the bloody civil war, the establishment of the Commonwealth under Cromwell, the restoration of the monarchy under Charles II, and finally



John Bunyan was "tall of stature, strong-boned though not corpulent, had somewhat of a ruddy face with sparkling eyes, wearing his hair on his upper lip after the old British fashion. His hair was reddish, his mouth moderately large, his forehead something high, and his habit always plain."

the attempt of James II to re-establish Catholicism as the national religion.

When he was about 17, Bunyan enlisted in the Parliamentary army and served for nearly three years. He does not seem to have been greatly affected by the war, though it stored his mind with a multitude of military scenes and pictures which he later used with telling effect in his books. Not long after his return from the war, when he was about 20, he married an orphan girl, whose name we do not know. "This woman and I," Bunyan tells us, "came together as poor as poor might be, not having so much household stuff as a dish or spoon betwixt us both." The young wife's sole dowry was two books, 'The Plain Man's Pathway to Heaven', and 'The Practice of Piety', which her father had left to her.

Awakening of Religious Feeling

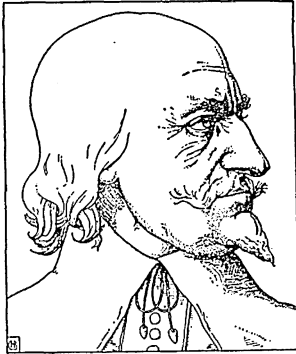
These books awakened Bunyan's interest in religion. He passed through a long period of intense spiritual conflict, the story of which is told in his 'Grace Abounding to the Chief of Sinners'. One Sunday, he tells us, after he had listened to a sermon on keeping the Sabbath, his conscience was greatly troubled; yet he went out to enjoy himself as usual with the game of tipcat. Suddenly, just as he was about to strike the "cat," a voice seemed to say to him, "Wilt thou leave thy sins and go to Heaven, or have thy sins and go to Hell?" He looked up to Heaven and imagined he saw Christ looking down sternly upon him. But fearing that he had already sinned beyond all hope, he desperately returned to his pleasures. After a long struggle, light broke through the dark clouds; he felt freed from his burden of sin and doubt; he was filled with peace and with confidence in God's mercy.

Meanwhile he had begun to read the Bible and had joined a little congregation of nonconformists. Before long he was preaching in the villages around Bedford with such fervor and eloquence that people flocked to hear him. When Charles II was recalled to the throne in 1660 and the established English church came back to power, he was arrested for disobeying the laws prohib-



This drawing of Christian, hero of 'Pilgrim's Progress', and the drawings on the next page of other characters from the book were done by Charles H. Bennett.

iting nonconformist meetings and was thrown into the jail at Bedford. There he remained for 12 years, with brief intervals of liberty. At any time he might



Pride

have gained his freedom by promising to give up preaching, but he said, "If you let me out to-day, I will preach again tomorrow." Hardest to bear was the thought of his family's suffering. His first wife had died, and just before his arrest he had married another noble-hearted woman. She cared tenderly for his four small children, one of them a

blind daughter whom Bunyan loved especially. While in prison he supported himself and his family by making tagged shoelaces. The rest of his time he spent in reading the Bible and Foxe's 'Book of Martyrs', in preaching to the other prisoners, and in writing religious books and papers.

At last, in 1672, the King suspended the laws against religious dissenters, and Bunyan was released. Three years later he was again put in prison for a few months. It was probably during this second imprisonment that he wrote the first part of 'The Pilgrim's Progress', which was published in 1678.

In the last years of his life Bunyan



Obstinate

won increasing fame both as a preacher and as a writer. Although he frequently preached in neighboring towns and even in London, he was never prevailed upon to give up his beloved congregation in Bedford, where he found his greatest happiness in ministering to his people and quickening their zeal.

A characteristic act of kindness finally cost him his life. While on a journey to London, he traveled some distance out of his way to reconcile an estranged father and son, and was caught in a drenching rain. A violent fever seized him and he died in London, Aug. 31, 1688, in his 60th year.

'The Pilgrim's Progress'

In writing 'The Pilgrim's Progress' Bunyan did not know that he was creating a masterpiece of literature, for of literature he knew almost nothing except the Bible. He merely had a message which he wished to give the people. In his writing, as in his preaching, he spoke to them

simply, directly, in plain language that they could understand.

'The Pilgrim's Progress' is an exciting adventure story and at the same time an allegory of the human soul—its struggles, temptations, sufferings, and final salvation. The story tells how Christian, the hero, bowed down with a burden of sin upon his back, flees from the City of Destruction and starts on a pilgrimage beset with many perils. After being almost sunk in the mire of the Slough of Despond, he laboriously follows the straight and narrow path up the Hill of Difficulty. He goes down into the Valley of Humiliation, where he battles with the



Discontent

foul fiend Apollyon, and into the still more awful Valley of the Shadow of Death. He passes through Vanity Fair with all its worldly allurements, is held captive by Giant Despair in Doubting Castle, and at last, after crossing the bridgeless River of Death, is received in the Celestial City. The characters that Christian meets along the way represent abstract qualities and defects, virtues and vices, as we can tell from their names—Obstinate, Pliable, Hopeful, Faithful, Mr. Worldly Wiseman, Mr. Talkative, and all the rest—yet

most of them are also real human beings who act and talk like the men and women Bunyan knew. They speak in the simple, lively, humorous language of the common people.

It was a happy accident for the world that Bunyan had little education and knew thoroughly only one book—the English Bible. The King James Version of the Bible, published 17 years before he was born, is the noblest work of English prose. Bunyan "lived in the Bible until its words became his own." The spiritual struggles and visions pictured in its pages were real to him. He had experienced similar struggles. He, too, had seen visions. He makes us see the things of which he writes because he himself had seen them. Because he could present vivid pictures in a few simple words, because he understood people and could create characters that have the illu-

Mrs. Bat's-Eyes and
Mrs. Know-Nothing

Mr. Worldly Wiseman

sion of reality, and because he could tell a story with dramatic and moving vigor, Bunyan paved the way for a kind of literature that had not yet taken form—the novel. Some critics, indeed, consider him the father of the English novel.

Of Bunyan's more than 60 published works the following are the best known: 'Grace Abounding to the Chief of Sinners' (1666); 'The Pilgrim's Progress' (Part I, 1678; Part II, 1684); 'The Life and Death of Mr. Badman' (1680); 'The Holy War' (1682).

A good biography of Bunyan is the one by James Froude, in 'English Men of Letters Series'.

BUNYAN, PAUL. The outstanding figure in American folk-lore is this legendary hero of the lumberjacks, a gigantic man who once ruled the whole continent.

The real Paul Bunyon (spelled with an "o") was a French-Canadian who took part in the Papineau uprising of 1837. After the rebellion he operated a lumber camp, and his crews told marvelous stories of his strength and bravery. These anecdotes fired the imagination of American lumberjacks, who delighted in their dangerous occupation and thought of themselves as a race apart from common men. They seized on Paul as a hero to personify their colorful, hearty, exciting life. But first they had him cross the border into the United States, anglicize his name to Bunyan, invent logging, and then start on his career of unmatched exploits.

By 1860 Paul Bunyan had become a legendary American hero. Gathered about the bunkhouse stove at night, the jacks vied with one another in adding exaggerated details to the growing saga. As lumbering spread from the Maine woods to Michigan, Wisconsin, Minnesota, and on to the Pacific Northwest, each part of the country hailed Paul as its own and contributed local variations.

The Amazing Exploits of Paul and His Helpers

Ol' Paul was pictured as a typical lumberjack, but mightier than any modern man. He towered above the tallest trees, covered 24 townships at a stride when he was in a hurry, combed his curly beard with a young pine, and could let out a bellow that would cause a landslide on Pikes Peak. His best helper was Babe the Blue Ox, who measured 42 ax handles and a plug of tobacco between the horns and who could pull anything that could be "hitched onto." Johnny Inkslinger, the bookkeeper, was another invaluable aid to Paul. He figured away with a fountain pen made from a rubber hose attached to a barrel of ink—and it took a bucket brigade of 30 men to keep the barrel filled.

Paul left his mark on the map of the whole United States. The Great Lakes he made as reservoirs for Babe's drinking water; the Alleghenies and the Rockies piled up when he dug a channel for the Mississippi; Puget Sound was intended as a grave for Babe; and Kansas is flat because Paul hitched Babe to it and turned it over to make good corn land.

Paul Bunyan ruled over the woods from the Winter of the Blue Snow until the Spring That the Rain Came Up from China and discouraged his heroic lumberjacks so badly that they became ordinary men again. Then

Paul saw that his work had ended, and he disappeared into the forests.

For many years the tales were told only by word of mouth. As story-telling began to die out in the camps, interested listeners decided to preserve the Paul Bunyan stories as specimens of American folklore. Some of the stories were published in 1914, and since then many books have appeared. A discussion of the tales, from the point of view of story-telling, and a bibliography of some of the important collections are given in the article Story-Telling.

BURBANK, LUTHER (1849–1926). With tireless persistence, frail Luther Burbank, world famous plant breeder, once grew 40,000 berry bushes to produce one new kind of berry. This amazing patience and industry characterized Burbank's entire career, enabling him to succeed where other men failed. He lacked health, scientific training, and, for long, money. But he loved plants and, as a young man, he read Charles Darwin's book, 'The Variation of Animals and Plants under Domestication.' Darwin's statement that new varieties of plants could be produced by cross-breeding inspired young Burbank to experiment.

Laughed at, pitied, and sometimes even reviled for "interfering with nature," Burbank persisted till he astounded the world by producing a white blackberry, a plum without a pit, a plumcot, a cross between a plum and an apricot, the beautiful Shasta daisy, and other plants never before known.

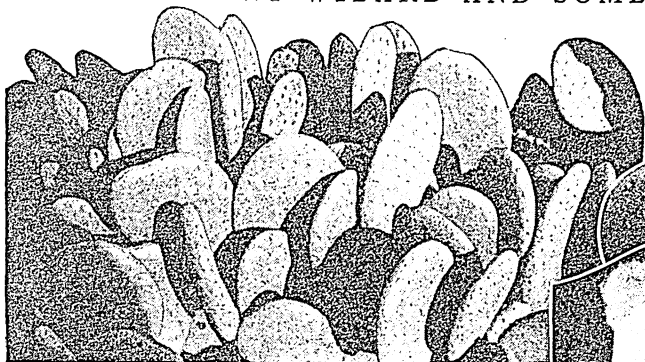
Improving the World's Food Supply

He improved the rose and the lily and his work with other flowers was extensive. His chief purpose in improving plants, however, was to add to the food supply of the world.

The most difficult and expensive, as well as the most interesting single series of experiments he ever made, he tells us in his autobiography 'The Harvest of the Years', was his work with the desert cactus. He worked 16 years with this plant, planted and studied more than 600 varieties, and emerged "scarred, pitted, and as full of spines as a pincushion." But in the end he evolved a plant which he believed would "grow with a minimum of care and cultivation on hundreds of thousands of acres now sterile, provide food for cattle, and revolutionize our stock problem."

But the best known work of the "plant wizard" is probably the Burbank potato, which added millions of dollars to the agricultural wealth of the United States. He noticed that potatoes in Massachusetts, his early home, were small and spoiled easily. To improve them he grew numerous plants. One plant bore a seed ball. By planting the seeds and then selecting only the best seedlings from each growth, he evolved in a few years a potato that was larger and that kept well. This is called breeding by selection, and is practised to some extent by every good farmer. Burbank's usual way of breeding plants, however, was to cross different plants or different species of the same plant to secure variations. This process is known as hybridization, and the results are hybrids.

THE PLANT WIZARD AND SOME OF HIS ACHIEVEMENTS



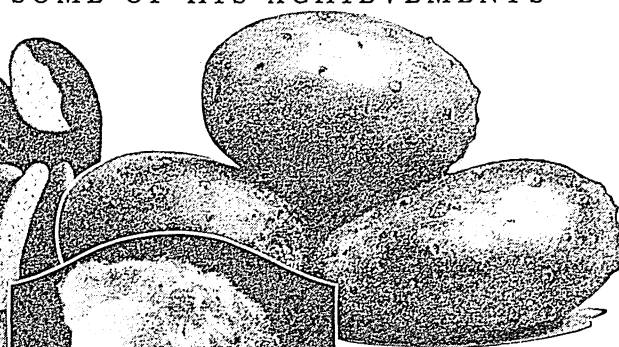
This is one of the many members of the cactus family which Burbank has "taught" to grow without thorns.

Having produced numberless forms, he ran his eye over the product and with amazing quickness and sureness of judgment picked out a few—sometimes only one among thousands—which were to be allowed to live and reproduce. The others were thrown away. (See *Plant Life*.)

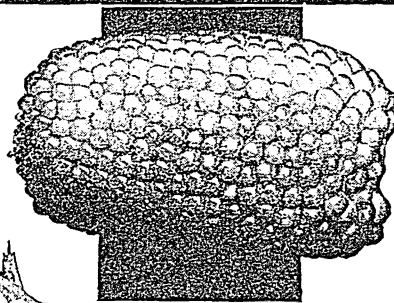
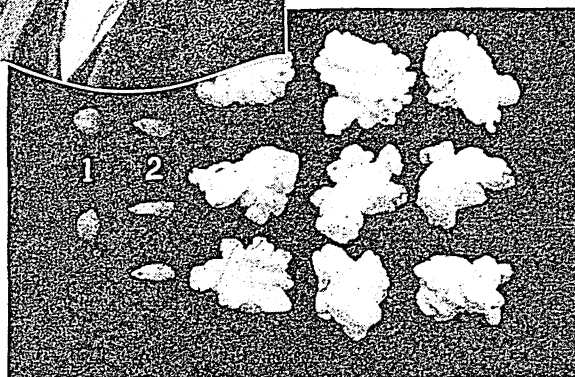
Burbank was born in Lancaster, Mass., of English-Scotch stock, received a grammar and academy education, and went to work in a plow factory. He showed that he had inventive powers even then, but he left that work for the kind of activity which he was to follow the rest of his life—market-gardening and seed-raising. His poor health demanded a milder climate; and using the \$150 which he had received for his rights in the Burbank potato, he went to Santa Rosa, Calif. There, after doing handy work about the farms in the neighborhood, he established a nursery, which he sold in spite of its being very profitable, in order that he might continue his experiments with plants.

Burbank was not primarily a scientist; he was chiefly an experimenter in plant breeding. His practical results in new flowers, fruits, and vegetables had, unknown to him when he began, found their scientific explanation in 1869 in the work of Mendel, an Austrian monk. Burbank's great success was due to his persistence and devotion, and above all, to his marvelously keen eye for discovering the one exceptional plant or "sport" amid thousands in a whole field.

The fame of his achievements has reached the far corners of the world. Foreign experts were sent by their governments to study the methods of the "wizard," and so numerous were the calls upon Burbank's time by interested visitors that he had to deny himself to most callers, living almost like a cloistered monk in the midst of his



Here we see the fruit of the "Thornless" prickly pear. This one of Burbank's "plant children" is eaten by human beings. The pulpy leaf of the prickly pear, robbed of its prickles, is a favorite and nourishing food for cattle in the southwestern states.



Burbank's "sorghum pop," supposed by him to be a cross between sweet corn and kafir, is pure white, and sweet. It "pops" like a firecracker, and there is no hard portion of the kernel left after popping. Fig. 1 shows a grain of the common popcorn, Fig. 2 the "sorghum pop." Below is the corn on the cob. Next we have the common garlic and Burbank's "elephant garlic," a single "clove" of which is as large as a whole cluster of ordinary garlic.

beloved plants until his death on April 11, 1926. While his work was confined to practical experimenting, his results have added to scientific theories regarding heredity and other biological subjects.

BURKE, EDMUND (1729-1797). In the stormy days before the American Revolution, during a bitter debate in the English Parliament over the question of taxing the American colonies, one of the members of the House of Commons hotly asked: "Should not America belong to this country?" A calm clear voice replied: "If we have equity, wisdom, and justice, it will belong to this country; if we have not, it will not belong to this country."

The voice was that of Edmund Burke, and his words were prophetic; for, if England had adopted the wise and moderate policies which he advocated, the history of America would probably have been very different. Again and again this Irishman—awkward in his tight brown coat and little bob-wig, yet a commanding figure nevertheless—rose in Parliament and fought, now with all the warmth of his passionate sense of right, now with the cold penetrating strength of his logic, for the principles of justice and liberty as he believed they applied to the great questions of the day.

Burke was usually on the losing side, but his influence was felt as a powerful force in his own time. His speeches—especially his magnificent addresses 'On Conciliation with the Colonies' and 'On American Taxation'—are read and studied today as masterpieces of oratory; and he is regarded as one of the greatest thinkers of his time on questions of state.

Burke's Dramatic Career

Born in Dublin, Ireland, and educated there at Trinity College, Burke came to London to study law. His 'Inquiry into the Origin of Our Ideas on the Sublime and Beautiful' brought him recognition as a philosophical writer, and he became a member of the famous literary club of which Dr. Samuel Johnson was leader. Johnson once remarked that "no man of sense could meet Mr. Burke by accident under a gateway to avoid a shower, without being convinced that he was the first man in England." Burke was soon able to support himself by his literary work, especially his yearly review and commentary on American affairs in the *Annual Register*.

In 1765 he became private secretary to Lord Rockingham, the Whig Prime Minister of the day,

and the next year was elected from a "pocket borough" to Parliament. Though Burke never held high office, he at once became prominent because of his wide knowledge, his penetrating judgment, and his brilliant oratory.

After his unsuccessful struggle in behalf of the American colonists, Burke came forward as the champion of another subject people, this time the natives of India. He moved the impeachment of Warren Hastings, the governor of India, whom he charged with plundering the hapless natives. Although Hastings was acquitted, and many now believe that Burke was overzealous in his attack, his powerful speeches drove home the lesson that the rights of a subject people must be respected.

When Burke later came out in opposition to the French Revolution, many of his former political friends regarded him as a "turncoat," saying he had abandoned the cause of liberty. But Burke had before argued only for the rights of the individual as against an unjust government. He was essentially a conservative and regarded the doctrines of the French revolutionary leaders as rash and destructive. Liberty, he held, is "inseparable from order"; and the lawlessness and bloodshed in France aroused his indignation. His views were expressed in a pamphlet entitled 'Reflections on the Revolution in France', to which James Mackintosh's 'Vindiciae Gallicae' and Thomas Paine's 'Rights of Man' were replies.

The Blow That Crushed Burke's Soul

Burke's attitude completed the breach with Fox and the Whigs, but in compensation he was made much of by the Court and the Tories. King George III wished to honor him by making him a peer; but before the title was conferred Burke suffered a blow which took from him all ambition for honor. He lost his only son, whom he loved passionately. "The storm has gone over me," he wrote, "and I lie like one of those old oaks which the late hurricane has scattered about me. I am stripped of all my honors; I am torn up by the roots and lie prostrate on the earth." A pension was all he would accept. He retired from Parliament and died three years later.

BURMA—LAND of RICE and PAGODAS

BURMA. Long before a ship reaches the hot coast of Burma, it enters a mud-stained sea. The mud comes from the rivers, which are loaded with rich soil washed down by heavy rains from the Burmese uplands. These conditions—warmth, good soil, plenty of rain—explain why Burma can grow huge crops of rice and support a large population.

Another symbol of Burma looms up as one nears its great seaport Rangoon—the gilded spire of the Shwe Dagon Pagoda. This towers higher than the dome of

Extent, Area, Population.—North to south, about 1,250 miles; east to west, about 620 miles. Area, about 260,000 square miles. Population, about 14,655,000.

Climate.—Monsoon type. Annual precipitation on seacoasts, about 100 inches; on southwest mountain slopes (Arakan, Tenasserim), about 200 inches; in central basin, about 20 inches. Temperature, at Rangoon, mean 79° F., range 10°; at Mandalay, mean 81° F., range 20°.

Cities.—Rangoon (capital, 400,000); Mandalay (135,000); Moulmein, Bassein, Akyab (40,000 to 70,000); Tavoy, Henzada, Prome, Muangyan, Toungoo, Pakokku, Pegu, Mergui (over 20,000).

the Capitol at Washington. It is the greatest of the many pagodas that dot the land and tell of the people's devotion to the faith of the tender-hearted Buddha, with its teachings of peace, kindness,

and the sacredness of life—even the life of animals. Those who know the Burmese say that there is no kindlier, happier people, when they are left alone to live in their ancient ways.

Unhappily, the story of Burma has another side. The country is wedged between the huge populations

of India and China, and has often had to fight for its existence. All too often its rulers have misused their powers for selfish ends. Hence the kindly Burmese have been continually plagued with wars, revolutions, and oppressions of every kind.

The Burmese Land and People

Burma is mostly a series of parallel mountain ranges, which extend south from Tibet until they dip beneath the Bay of Bengal (for map, see Indo-China). In the west the Arakan range, with some 10,000-foot peaks, raises a rampart against India; the northernmost portion is called the Kachin Hills. Along the eastern border runs the mountain backbone of the Indo-Chinese and Malay peninsulas. In the northeast this forms the Shan plateau, about 3,000 feet above sea level and deeply carved by river valleys. Farther south it is only a sharp ridge separating the narrow coastal district (Tenasserim) from Thailand. In central Burma, between these ridges, lie the hills called the Pegu Yoma. Their highest point is an extinct volcano, Mount Popa (5,000 feet). Sloping up to meet the Himalayas, Burma reaches its highest in the north, about 19,700 feet.

To the west of the Pegu Yoma runs Burma's greatest river, the Irrawaddy, with its main branch, the Chindwin. To the east are the Sittang and the Salween. All three rivers have filled their lower valleys with rich soil from the uplands, and together they have built a great delta out into the Bay of Bengal. The mountain barriers explain much of Burma's past. The high barrier in the northwest hampered immigration from India and prevented conquest. The population of Mongolian stock has drifted in from Greater China ever since prehistoric times. But, because they are so near to India and even for a time formed part of the Indian Empire, the people are more Indian than Chinese in their culture.

The differences among the people correspond closely to differences in the land. The most advanced of them, the Burmese, live in the fertile lowlands, and make up three-fourths of the population. The highlands are held by less advanced peoples—the Shans on the Shan plateau, the Kachins in the far north, the Chins in the west, and the Karens on part of the Arakan range, in the Pegu hills, and on the Thailand frontier.

The hill peoples live in stockaded villages, and practise rude farming. They believe in nature gods and magic, and they hunt heads when they can. The

most accessible of them, the Karens, have been the most responsive to Christian missionary efforts.

Climate, Plants, and Animals

The natural life is dominated by the monsoon climate. From October until February the cool, rainless winter monsoon blows from the northeast. A hot dry season follows, until the wet monsoon bursts from the southwest in late May or early June. Then the seacoasts and southwestern mountain slopes are drenched with rain. But the central interior, screened by the Arakan range, may get only 20 inches in a whole year. The higher Shan plateau receives a little more. Temperatures range from fully tropical at sea level to cool on the mountains and in the far north.

The seacoasts are blanketed with mangrove forests and a tangle of creepers (see Mangrove). Immediately above tidewater, the mangroves give way to other tropical trees. These continue up to 3,000 feet above

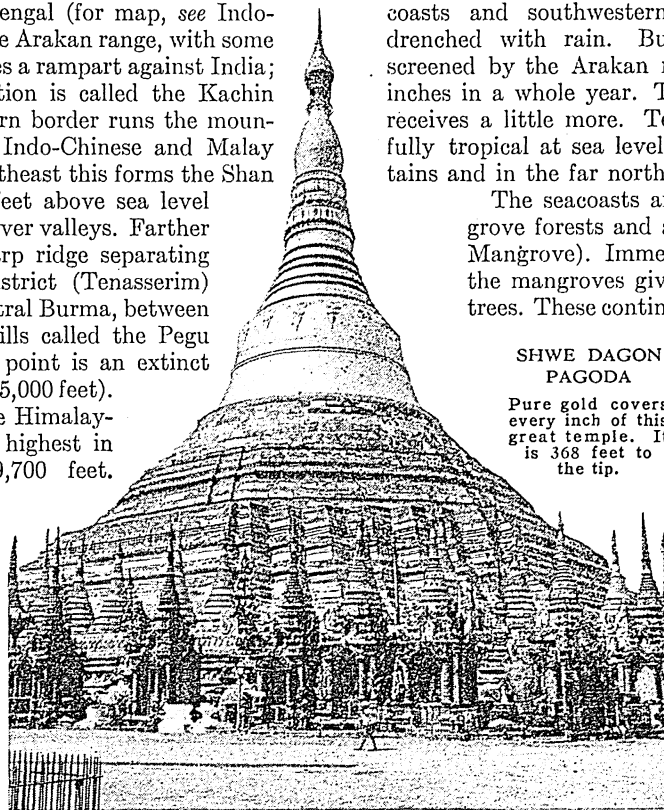
sea level. This zone furnishes the timber trees, the teak and the pyingado. Higher up, oaks and chestnuts appear and then pines. Elsewhere the central Mandalay basin is dry, with thorn bushes and cactus. In the dry season, even along the great river, the yellow earth becomes cracked. The river runs low and boats may be stranded for months.

The animals include gibbons, monkeys, elephants, tigers, and the rhinoceros. Malayan and Himalayan black bears are found in the hills. The small barking deer (*gyi*), wild oxen, and buffaloes are common. Bats and parrots flit among the trees. There are pythons and other snakes, as well as lizards.

How the Burmese Use Their Land

Crowded countries in Asia envy Burma, because it seems to have plenty of room. It has an area nearly as large as Texas to support a population about equal to that of New York State. But much of the land is in the dry hill country and is ridden by malaria. In the fertile regions many tropical diseases keep the population from growing to the limits of the food supply (see Indo-China). This enables Burma to produce a surplus of rice for export.

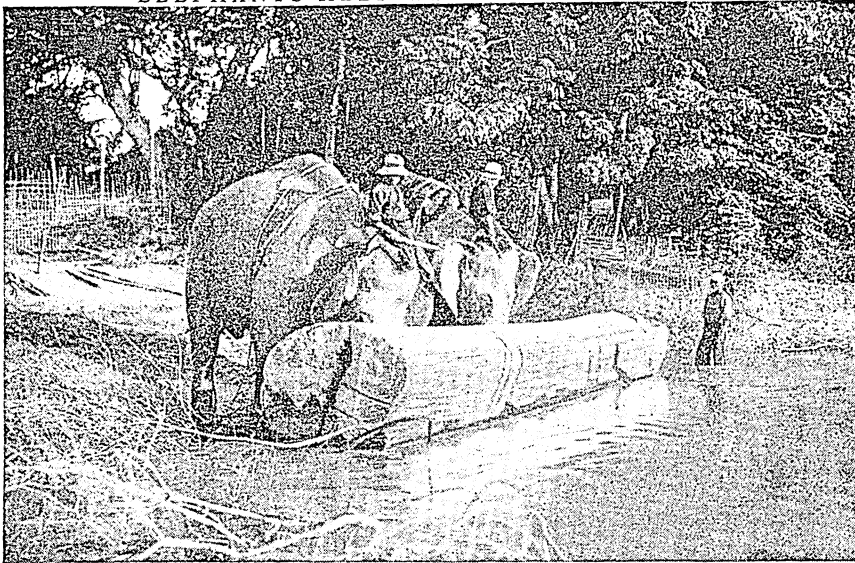
The crops range from rice to buckwheat, in keeping with the land's varied rainfall, temperature, and altitude. The best crop region is the steaming rain-drenched land of the deltas and the sea coasts. The next best land is the drier Mandalay basin. This is a region of mixed farming, producing millet, sesame,



SHWE DAGON
PAGODA

Pure gold covers every inch of this great temple. It is 368 feet to the tip.

ELEPHANTS HELP WITH A LOG OF TEAK



The Burmese use elephants instead of machinery to do much of their heavy work. Here two tuskers are rolling a log of heavy teak into a river, so that it may float downstream to a sawmill. It may arrive two years later, because many logs are stranded on sandbars during the dry season.

beans, peanuts, corn, and cotton. Rice is grown on irrigated fields.

On the highland slopes, crops are grown chiefly for local use. Tea and rice (here grown on terraces) are raised up to 5,000 feet. There cool-climate crops begin, such as corn, beans, peas, opium poppies, and buckwheat. Some rubber has been grown in Tenasserim, but with little success because of the sharp seasonal changes between drenching rain and extreme dryness. Tobacco is a large crop, to make the huge cheroots smoked by men, women, and even children.

Forests and Minerals Are Important

More than half the country is thickly covered with forests. These supply much of the world's teakwood, which elephants drag to the rivers (see Teak). Other trees furnish bark for making cutch, a yellow dye used in tanning.

Burma's greatest mineral wealth is the petroleum field of the Mandalay basin, with its centers at Yenang-yuang and Sinbu. Pipe lines convey the crude oil to Rangoon for refining. The Kachin hills supply the world's finest jade. This is carried to China for sale as "Chinese jade." The Shan plateau has highly developed sil-

ver and lead deposits, large beds of lignite, and ruby mines (see Gems and Jewelry). Tenasserim yields tin and some tungsten. Iron, zinc, copper, nickel, and gold are also mined on a small scale.

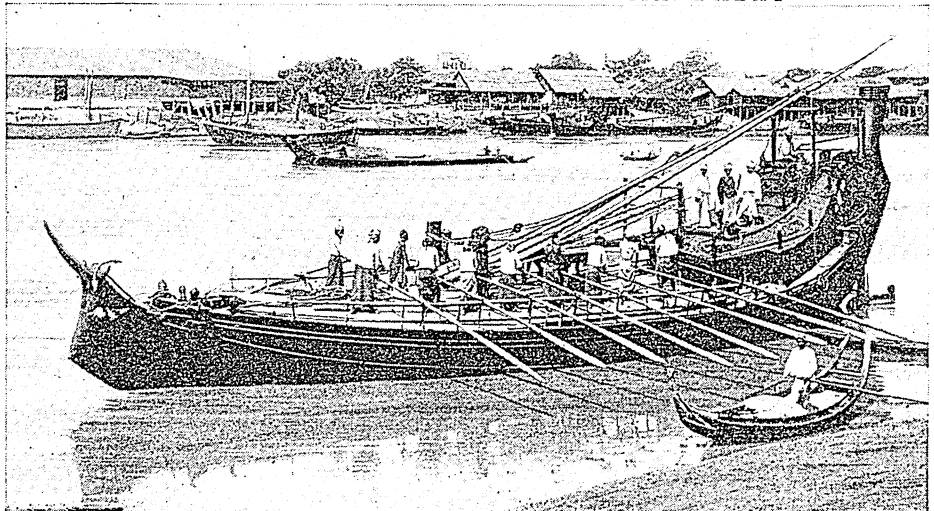
Oppressive climate and lack of good coal and iron have held back manufacturing. Most of the mills process raw materials such as rice, timber, and cotton. The chief exports are rice, petroleum, and cotton, which go mostly to India. Others are teak and minerals. Important imports are cotton goods, machinery, and other manufactures.

Rivers Instead of Roads

In this land of mountain barriers and seasonal floods there are only some 4,000 miles of improved highways. The delta has virtually none except the road northward from Rangoon. At Lashio begins the famed Burma Road, which links the railhead with Kunming in southwestern China. Rangoon is connected by narrow-gauge railroads with Moulmein and Mandalay, and another line connects Mandalay with Lashio. Far to the north, rough roads twist over dizzy mountain heights from Bhamo to the Bengal border, and across the northern tip of Burma from China to Assam.

The rivers are the main routes of transportation. The Irrawaddy is navigable by large steamers the year around as far as Bhamo, 900 miles up. Small craft can travel a hundred miles or so farther north in the

WOMEN ROW A BOAT AT FABLED MANDALAY



The graceful lines and the two-piece mast of this Burmese craft remind one of the ancient river boats of the Nile and the Tigris. The same curving lines appear in the rowboat on the near river bank. The sheds on the farther bank are set on piles to be above flood water.

rainy season. Native boats use the Salween for local trips between the many rapids, as far north as the Chinese border.

A Land of Few Cities and Many Villages

Rangoon, the capital, largest city and chief port, is near the tip of the delta. A few miles east across the Gulf of Martaban in Tenasserim is Moulmein, heart of the tin region. The only other large city is the old capital, Mandalay, which stretches for some six miles along the Irrawaddy in central Burma. Its noisy bazaars, many pagodas and monasteries, and its mixed population of Burmese, Chinese, Hindus, hillsmen, and whites make it a fascinating place to visit.

Most of the people live in villages, set on piles to escape floods and the water used to irrigate the rice fields. The houses are built of bamboo or teakwood, with thatched roofs. The only furniture is a low table and grass mats. Around these homes the farmers work their fields with water buffalo or small humped oxen.

Some towns have bazaars, but many depend upon bazaar boats. These floating stores buy the villagers' wood carvings or silverwork, and sell the few articles the people need. The great staple is cloth for the jackets and skirts that both sexes wear.

Modern Problems

The Burmese are better educated than most Orientals. Each village has its own pagoda and its yellow-robed Buddhist priests, who teach the children to write a script akin to the ancient Pali alphabet of India. The language, however, is like Chinese. There is a university in Rangoon. Burma has no caste system, and women enjoy more privileges than is common in the Orient. They have the right to vote, and they do much of the small business, for the men are inclined to be indolent.

The country has been a notable field of American missionary endeavor ever since the time of the Rev. Adoniram Judson, who began work at Rangoon in 1813. Many converts, compilation of a Burmese grammar and

dictionary, and a Burmese translation of the Bible were among the fruits of his 37 years' service.

Before Japan invaded Burma in 1942 and upset normal government and business, the Burmese considered that their most pressing problem was foreign domination of business and of the best occupations. Their

large industries had been built up by the British. Hindus and Chinese controlled most of the small mills and stores. Hindus came by hundreds of thousands during the busy seasons for rice milling and working up teak. When the Burmese won a separate government as a British crown colony in 1937, they tried to enlarge their share of industry and business by levying tariffs and taxes, and redistributing the land; but they were severely hampered by inexperience and lack of native capital.

Burma's History

Before European nations began to found trade empires in the Orient, Burma's history was a long record of wars with its neighbors, and internal struggles to win and hold royal power. In the 17th century the Portuguese, the Dutch, and the English opened trading posts; but only the English kept a foothold. During the 19th century, between 1826 and 1886, trade and frontier disputes led Great Britain to take over the country. By victories in 1842 and 1852, the British took over the delta region or Lower Burma, leaving a native ruler at Mandalay. In 1885 another dispute led to conquest of this region. Annexation was proclaimed on New Year's Day, 1886. Bur-

ma then was part of India until it was made a crown colony, with its own constitution, in 1937.

This constitutional government did not include the hill tribes of the northeast, the Chin hills, and a mountainous portion of Arakan. Control of the Federated Shan States in the northeast was vested directly in the governor. Three non-federated Shan states kept their own tribal government, with general supervision by the Burma Frontier Service. (See also Indo-China; for the war with Japan, see World War, Second.)

BURNS, ROBERT (1759-1796). In the years when the United States was winning independence from England, a Scottish boy was doing a man's work on his father's farm. But his thoughts were far from the fields. In his pocket he had a book of poetry or an

DRESSED FOR THE HOT SUN OF BURMA



This 14-year-old girl tops her turban with a straw hat as big as a parasol before going out into the hot sun. She has the usual short jacket and wrap-around skirt that are worn by both sexes. The women's jacket is usually white and double-breasted; the men's is usually of some dark color and single-breasted.

old play or some other volume from his father's slender library; and when the horses would rest at the end of a furrow, he would snatch a few hasty glances at the words he loved so well, to turn them over and over in his mind while he plodded down the next furrow. And at night he loved to try his hand at writing verses picturing his admiration for some pleasant-faced lassie, or describing the sights and sounds of his life in the fields. All living things were dear to him, and when his plow relentlessly uprooted a mountain daisy he would pause to mourn in such matchless lines as these:

Wee, modest, crimson-tipped flower,
Thou'st met me in an evil hour;
For I maun crush amang the stour
Thy slender stem.

And if some terrified little field mouse were driven by a similar mishap from his warm underground home, the boy would grieve for the "wee, sleekit, cowerin', tim'rous beestie."

Such was the boyhood of "Bobby" Burns, Scotland's greatest poet, whose songs of humble life have sung themselves into the hearts of the world. He was born near the village of Ayr in such a home as he pictures for us in "The Cotter's Saturday Night." His father was a fine type of Scotch peasant, honest, intelligent, and god-fearing; but his unceasing toil from morning till night could barely wrest a livelihood from the stubborn soil, and Bobby, the eldest of seven children, was forced at 13 to begin his labor on the farm and at 15 to do a man's work.

But hard though their life was, Bobby and his brothers and sisters enjoyed many precious hours when the day's toil was done, listening while their mother sang to them songs of early days, or hearing their father read aloud the stirring tales of the Bible. The whole family loved to read, and visitors dropping in at mealtime would sometimes find them all seated around the table, a spoon in one hand and a book in the other. But "the unceasing toil of a galley-slave" overtasked the youthful poet's strength and threw him into fits of melancholy from which in later youth he sought refuge in the gay tavern life of the village, forgetting his sorrows in scenes of what he called "swaggering riot and roaring dissipation."

The "Ploughboy Poet" Leaps into Fame

By the time he was 26 his father had died, and Burns, discouraged by the hard struggle against poverty as well as by a disastrous love affair, decided to leave for the island of Jamaica to begin life anew. To get money for this venture, he published a volume of the verses he had been writing since boyhood. They met with instant success, and the fame of the "Ayrshire ploughman" grew so great that Burns gave up his plan to emigrate. He received about \$100 for

his share of the profits on his book of verse, a single copy of which is now worth thousands of dollars. With this money he went to Edinburgh, where he was flattered and feasted, petted and lionized by the learned and wealthy. After a season the novelty of the ploughboy poet wore off, and the fickle crowd forgot him. Burns, who had received all their attentions with simple dignity, went back to Ayrshire, unaffected as before, not without some feeling of bitterness toward those of high station, but with a stronger love than ever for the common man.

In 1788 he married "Bonnie Jean" Armour, whom he had long loved, and soon after he received an appointment as inspector of the liquor customs, which, together with his farming, promised to secure him a livelihood. But the new office proved his undoing, for he was thrown more than ever into riotous company. Weakened by drink and dissipation, he contracted a fever, and died at the age of 37.

Burns' Place among the Poets

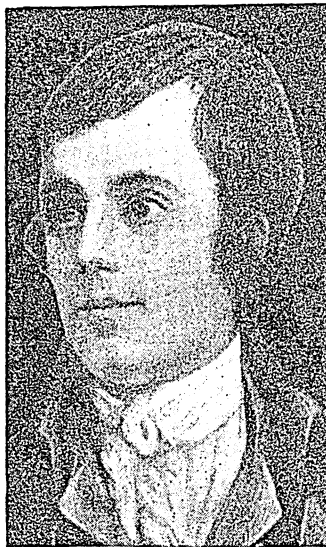
In spite of his frailties, Burns is one of the best of lyric poets. The soil, the air; the very spirit of his native country is in his verses, so that "you can fair smell the heather." His best poems are in the Scottish dialect. But his humanity embraces the whole world. No one before him had sung with such genuine feeling the worth of the common man, as he does in 'A Man's a Man for a' That':

The rank is but the guinea stamp,
The man's the gowd (gold) for a' that.

His sparkling, often rollicking, humor, his joyousness, his deep seriousness, and tender pathos are some of the many sides of the great heart revealed in his poems. He is the greatest song-writer in the English language. His patriotism and love of freedom breaks out in ringing war-songs, as 'Scots Wha Hae wi' Wallace Bled', while in the music of such love-songs as 'I Love My Jean', 'A Red, Red Rose', 'The Banks o' Doon', 'Highland Mary', and 'To Mary in Heaven', we catch the very heart-beat of the poet.

Among the most familiar of Burns' many poems are: 'The Cotter's Saturday Night'; 'To a Mouse'; 'To a Mountain Daisy'; 'Address to the Deil'; 'Address to the Unco' Guid'; 'A Bard's Epitaph'; 'I Love My Jean'; 'Auld Lang Syne'; 'John Anderson, My Jo'; 'The Banks o' Doon'; 'Highland Mary'; 'My Heart's in the Highlands'; 'Scots Wha Hae wi' Wallace Bled'; 'A Man's a Man for a' That'; 'Tam o' Shanter'.

BURR, AARON (1756-1836). Third vice-president of the United States, Aaron Burr was a man of brilliant gifts, who was betrayed by vanity and ambition into questionable if not treasonable enterprises. Born in Newark, N. J., he was graduated from Princeton College in time to win distinction in the Revolutionary



ROBERT BURNS
The Ploughboy Poet

War. For some reason never made public, Washington reversed his first favorable opinion of him.

As a lawyer in New York City, Burr's fine mind, polished manners, and magnetic personality brought him rapid rise in social and public life. He was elected to the United States Senate in 1791, and to the vice-presidency (with Jefferson) in 1800. But the party of Jefferson soon abandoned him, and in 1804 he became the candidate of the Federalists for the governorship of New York. Alexander Hamilton, however, and other leading Federalists opposed him because they believed his political conduct was unscrupulous, and he was defeated. Angered by this, Burr challenged Hamilton to a duel, and killed him. Although acquitted on the charge of murder, he had destroyed himself socially and politically.

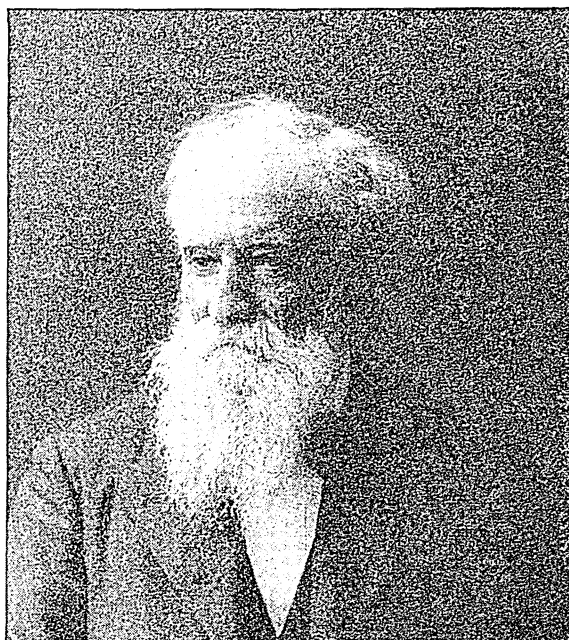
Burr then engaged in an obscure conspiracy for the supposed purpose of forming a new republic on the lower Mississippi, with himself as a Napoleonic conqueror of a part of Mexico, and with a gay French capital in New Orleans. An armed expedition was actually launched on the Ohio, when Burr was arrested in 1807. Treason was not proved, but popular opinion as before condemned him. Then his idolized daughter, Theodosia, wife of Governor Alston of South Carolina, whom Burr himself had educated into one of the most charming and intellectual women of the day, was lost (in 1812) in some mysterious tragedy of shipwreck or piracy at sea. Burr returned to New York, but was unable to recover his law practice. Ruined, and forsaken by his friends whom he had used and betrayed, he died at the age of 80 in poverty and neglect.

BURROUGHS, JOHN (1837-1921). Once John Burroughs, the famous essayist who wrote so much about nature, was asked to write to a class of children who were studying rhetoric. This, among other things, was what he wrote: "I think I have got more help as an author from going a-fishing than from any textbook or classbook I have ever looked into. Your teacher will not thank me for encouraging you to play truant, but if you take Bacon's or Emerson's or Arnold's or Cowley's essays with you, and dip into them now and then while you are waiting for the fish to bite, she will detect some fresh gleam in your composition when next you hand one in."

Not many boys, however, make fishing what John Burroughs made it, an opportunity to study nature and the best essayists at the same time. The letter is not so much advice as it is a revelation of the man Burroughs, who more successfully than any other writer of our age has joined nature study with literature and the lives of men. Thoreau could live a recluse at Walden Pond, but Burroughs could do this and turn from it to the human pleasure of tramping and arguing with Theodore Roosevelt. It is no wonder that children all over the country loved Mr. Burroughs. Not only children, but grown-ups too, have made pilgrimages in thousands to his simple cottage "Slab-sides" near the Hudson River, and his other homes.

Born on a farm in New York State, he grew up among the sights and smells of the country. When a little older he taught in a country school for about eight years. Then he worked at a clerkship in the treasury department in Washington for ten years more, and was afterwards a national bank examiner. But business did not satisfy him, and when he was 46

JOHN BURROUGHS



The philosopher-student of Nature, who has read "sermons in stones and books in the running brooks." His essays are distinguished by original thought and literary charm.

he built a house on the banks of the Hudson River, where he lived the peaceful contemplative life he loved, cultivating fruit and writing.

Burroughs was a writer by instinct and at 14 had already begun to write essays. At 24 he succeeded in having an essay published in the *Atlantic Monthly*, and from then on he became a frequent contributor to magazines and newspapers, and also wrote a large number of books. Most of these are on nature study, though a few are on literary subjects. He also wrote some delightful records of travel.

Burroughs' best-known works are: 'Wake Robin' (1871); 'Winter Sunshine' (1875); 'Birds and Poets' (1877); 'Whitman, a Study' (1896); 'Squirrels and Other Fur Bearers' (1900); 'Ways of Nature' (1905); 'Camping and Tramping with Roosevelt' (1907).

BUTTER. Who was the first butter-maker? Perhaps he was an Arab who, after a journey on camel-back, opened the skin bags of milk which he had brought with him and discovered rich yellow masses of butter floating on top. Jolting cream in skin bags or gourds, carried on the backs of donkeys or dragged after a galloping horse, is an ancient method of butter-making which is still used in some parts of South America and in certain oriental countries.

Although butter was known at least 4,000 years ago, it did not become a staple article of food until comparatively recently. In early times it was made from the milk of sheep and goats by crude churning processes, and hence could have had little resemblance to the palatable and nutritious butter of today. It was chiefly used as medicine, as an ointment after bathing, and as an oil for burning in lamps. It was used to a certain extent in cooking, but olive and other oils were used more commonly for food, as is still the rule in southern Europe. It is now recognized that butter is a very important food for both children and adults. Since it is so largely fat, a small quantity contributes many calories to the diet. It also has a high concentration of vitamin A, which stimulates growth in children and protects both children and adults against colds and other diseases of the breathing passages (see Vitamins).

In India and Central Asia a peculiar form of butter, called "ghee," is commonly used. It is much like the clarified butter used by orthodox Jews in *kosher* (ceremonially clean) cookery, being made by boiling the water out of freshly made butter and adding salt and sometimes sour milk and herbs. The people of Tibet are especially fond of butter in this form, even putting lumps of it into tea. (See Dairying.)



A portrait of little Miss Buttercup, taken as she stood dancing in the breeze of a sunlit field.

but June finds them at their best and in greatest profusion.

The buttercup belongs to the crowfoot family, and has bright green leaves and yellow flowers with five

smooth shining petals. Of the better-known species, the first to bloom is the bulbous buttercup of field and roadside. It is followed closely by the swamp or marsh buttercup, which loves the moist, shady spots,

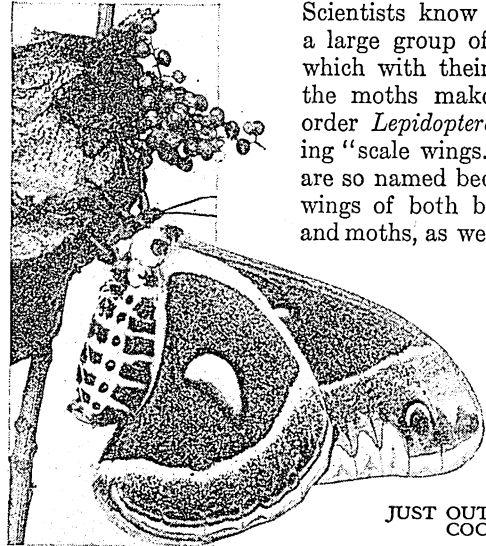
and the common meadow variety, sometimes called the blister flower because its acrid juice causes blisters when touched to lips or tongue. This familiar little plant is a native of Europe, but now belongs quite as much to us, for it is found throughout the United States and Canada.

Scientific name of common meadow buttercup, *Ranunculus acris*. Flower about

one inch across, with long slender footstalks; calyx has 5 spreading sepals; corolla 5 petals; stamens and carpels yellow. Stem erect, branched, and hairy; 2 to 3 feet tall, growing from fibrous roots. The leaves at the base grow in tufts with long petioles and are cleft into numerous lobes; stem leaves spring directly from the stem and usually have three parts.

BUTTERFLIES AND MOTHS. A poet has prettily called butterflies "stemless floating flowers."

Scientists know them as a large group of insects, which with their cousins the moths make up the order *Lepidoptera*, meaning "scale wings." They are so named because the wings of both butterflies and moths, as well as cer-

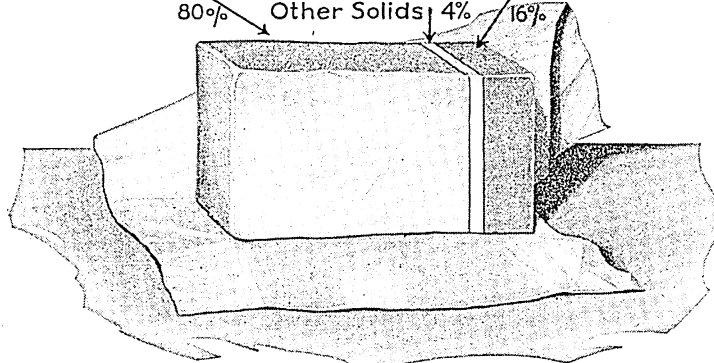


JUST OUT OF THE COCOON

A female Cecropia Moth, just after she came out of her cocoon, is here shown resting near a cluster of berries, waiting for her wings to dry.

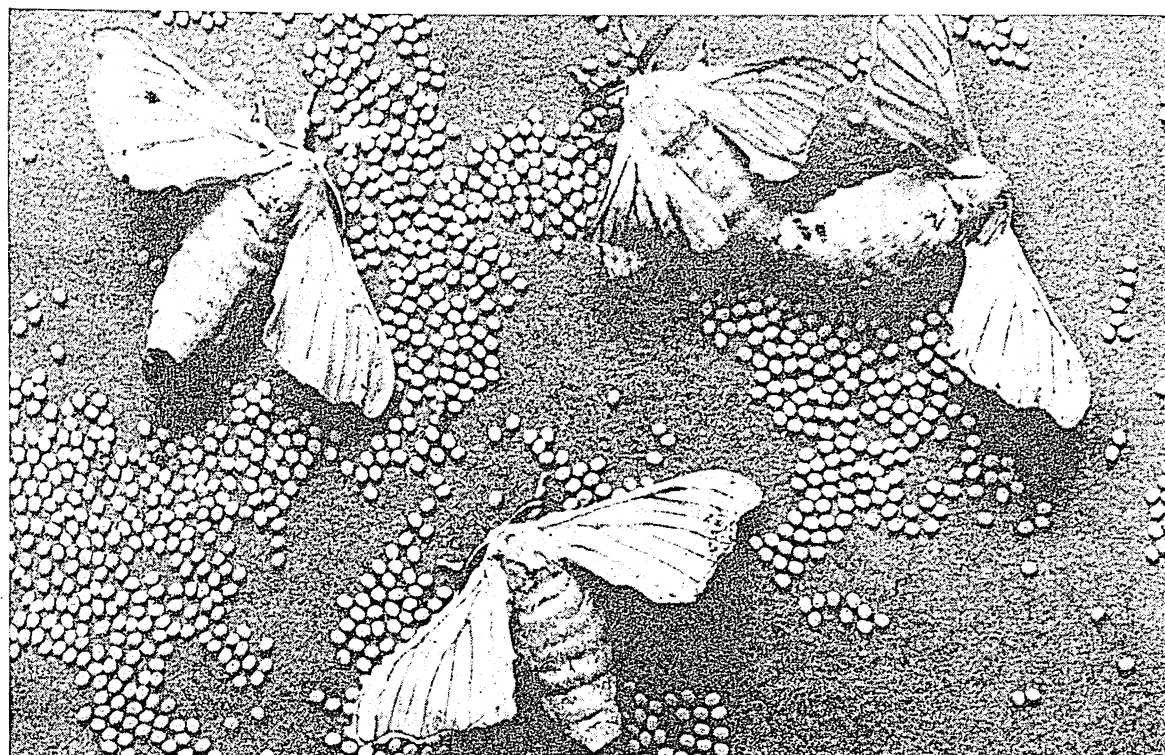
tain portions of their bodies, are covered with a very fine soft glistening dust, which if examined under a compound microscope is seen to be made up of millions of little scales, of very pretty outlines. Some of these scales are very much like little feathers, some like fans; and all have a tiny stem by which they are fastened.

WHAT BUTTER CONTAINS
Fat 80% Salt, Casein, and Other Solids 4% Water 16%

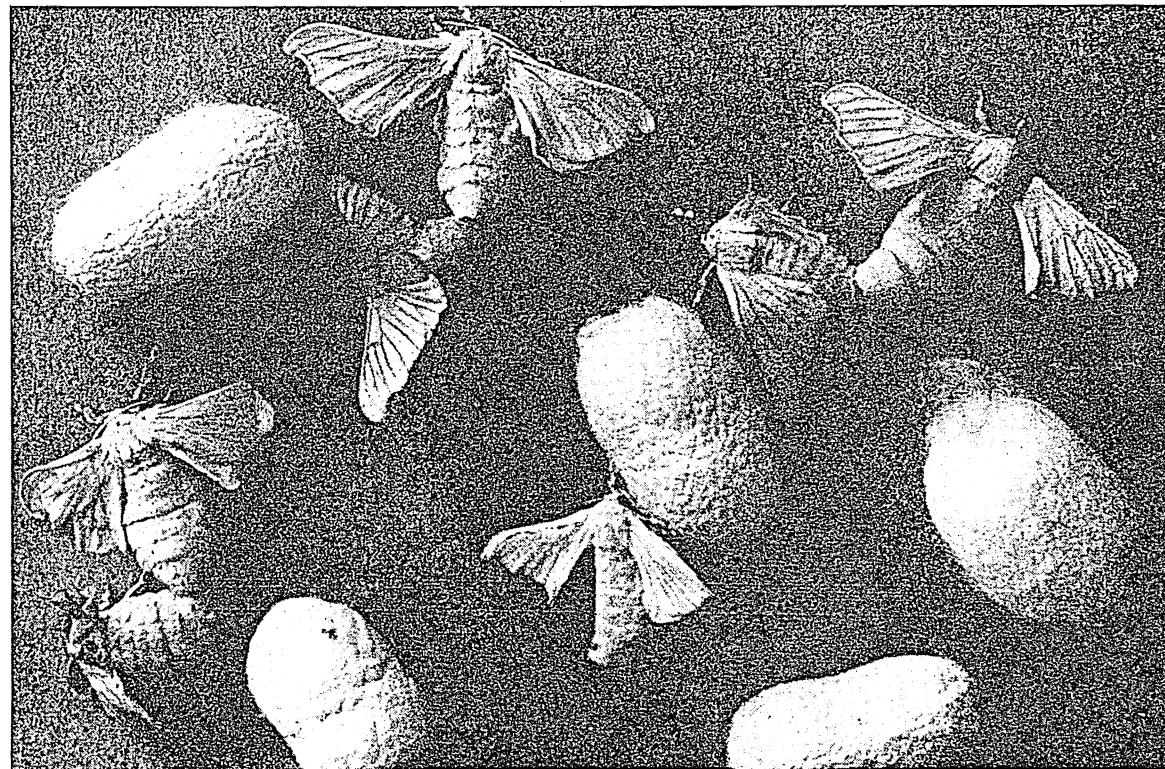


Butter must contain at least 80 per cent of fat, according to United States federal specifications, and not more than 16 per cent of water, by weight. In salted butter, salt and casein make up most of the remaining 4 per cent. Some states require an even higher proportion of butter fat.

BEGINNING AND END OF THE SILK MOTH

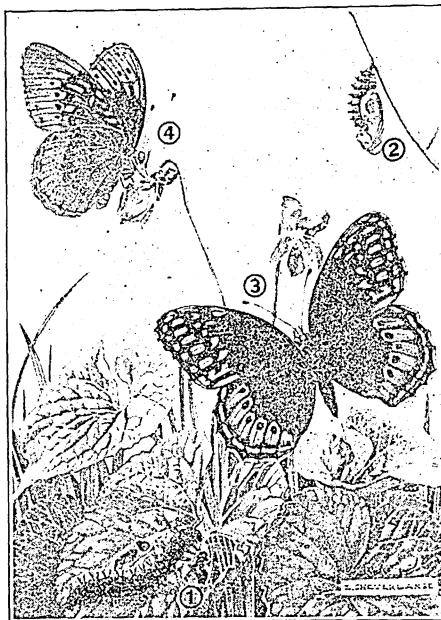


Each of these female silk moths (*Bombyx mori*) lays from 300 to 500 tiny eggs in its five days of life. They are inconspicuous little moths, less than an inch long and ashy white in color. Centuries of domestication have deprived them of the use of their short, weak wings. Long before the eggs have hatched into greedy larvae, or caterpillars, the parents will be dead.



The caterpillar spends a month devouring mulberry leaves. While growing from $\frac{1}{8}$ th of an inch to about $3\frac{1}{2}$ inches long, it molts, or sheds its skin, four times. Then it spins a silken cocoon, in which it lives for about two weeks as a pupa, or chrysalis. Here we see the final stage of its metamorphosis, in which it comes out of its cocoon as an adult moth.

THE LIFE HISTORY OF A BUTTERFLY



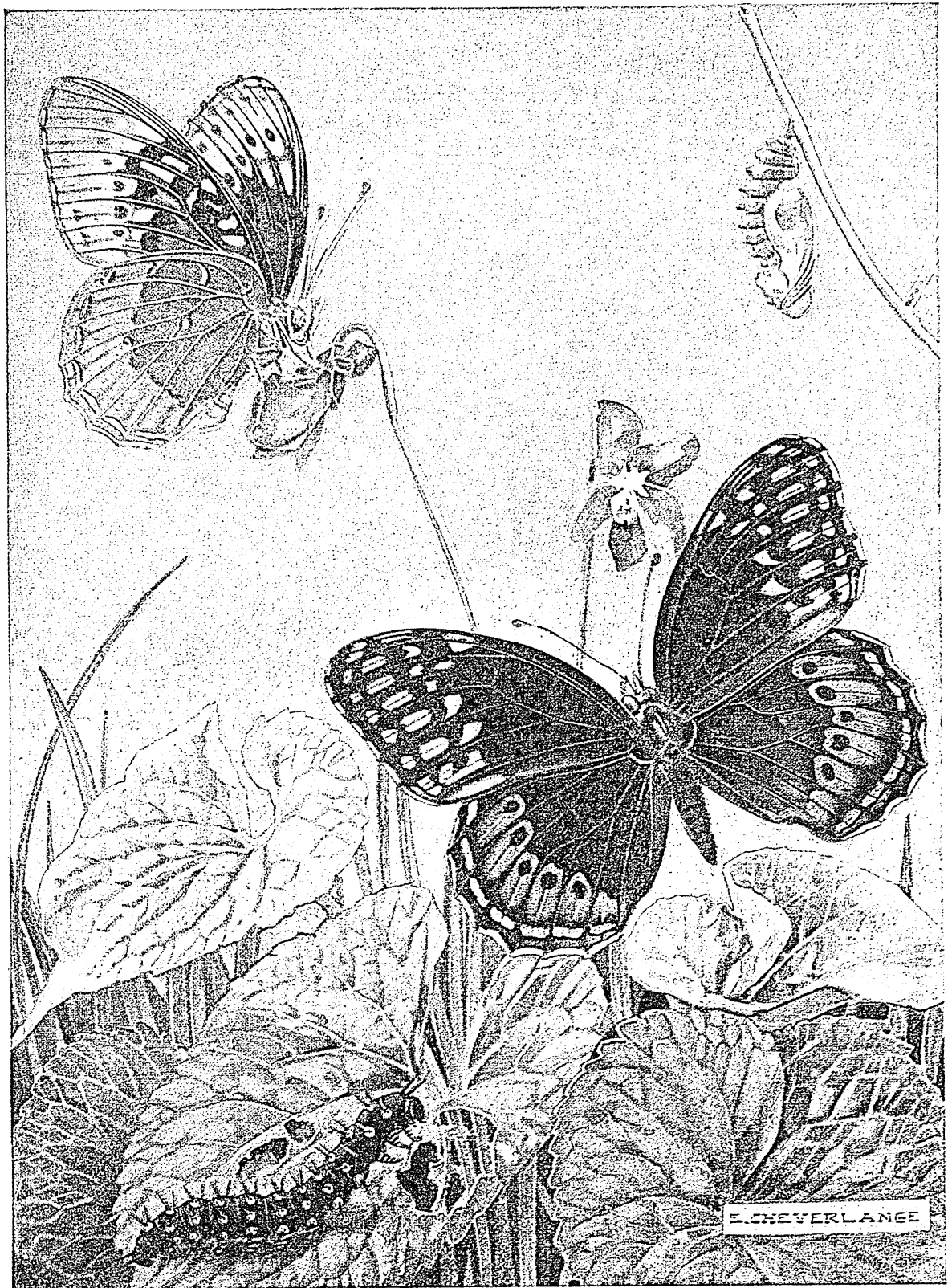
KEY TO COLOR PLATE

THE opposite page depicts the important phases in the life of a butterfly. The species shown is the Diana (*Argynnis diana*), belonging to the tribe of the fritillaries. This species illustrates conspicuously how certain butterflies show such a marked difference in appearance between the two sexes that they are easily taken for unrelated types. The female Diana (3) lays her eggs on the leaves of wild violets, where they hatch out into tiny caterpillars which lie concealed beneath the leaves by day and come out to feed upon them at night. The caterpillars increase in size rapidly, shedding their skin

many times. When full-grown (1) they are covered with stiff spines rising from brilliant reddish spots that girdle their bodies.

The next step in the life of a Diana caterpillar is the climb to the top of a nearby twig where it suspends itself by a band of silk and turns into a pupa or chrysalis (2). It may remain in this state for only a few weeks or, if the season is late, it may hang there all winter and spring in a condition of arrested development. In any case, its chrysalis days end with a complete transformation, and it finally breaks out of its shell—an adult butterfly. The male (4) in the picture is feeding upon the nectar of violet blossoms.

Dianas are found throughout the Appalachian region, from Virginia to Georgia and Ohio to Arkansas. The picture shows them life-size. They are regarded as the most magnificent among the American fritillaries, of which more than 45 other species are known.



Painting by Elie Cheverlange

See text on opposite page

THE LIFE HISTORY OF A BUTTERFLY

Most of the butterflies fly during the daytime and sleep during the night; with the moths it is often just the reverse. A good way to distinguish between the moths and the butterflies is by the shape of the antennae or feelers. The antennae of the butterflies are thin and have their ends rounded into little clubs or knobs, while the antennae of the moths are not tipped by these knobs. Many of the antennae of moths are shaped like tiny feathers. In addition the butterflies usually hold their wings vertically over their backs when at rest, while the moths let them lie flat open.

It is a mistake to think that the moths are all plain and sombre in color, while the butterflies are more brilliant. Some of the most beautifully colored members of the whole order are moths. One of our commonest moths, the luna moth, is a beautiful green color with a transparent center or "eye-spot" on each wing and long curved hind wings, and is surely as handsome as any butterfly. There are many more species of moths than there are of butterflies. In North America north of Mexico there are about 8,000 of the former and only about 700 of the latter. The butterflies, however, probably because they are more active in the daytime, are the best known to most people. They fly about from flower to flower and are often as prettily colored and fashioned as the blossoms they visit.

Upon the thorax, or middle section of the body, all butterflies and moths have two pairs of wings, the pair in front commonly the larger. The scales on the wings usually contain a pigment that gives the wings their color. The iridescent shimmer on the wings of some butterflies, however, comes from scales covered with ridges so close together that they break up the light that falls on them into the colors of the spectrum. The mouth is really a long slender sucking tube which, when not in use, is coiled up like a delicate watch spring. By uncoiling this tube, the insect probes deep into the flowers and sucks up the sweet nectar for its food.

The life history of the butterfly and the moth is almost identical. The female butterfly or moth lays a great many eggs, and from these hatch out tiny

worm-like grubs, called caterpillar larvae (see Caterpillars). These grow rapidly, and shed their skins several times. Caterpillars crawl about among the leaves of plants and feed on them. They are very greedy creatures indeed, and do nothing but eat and fill their stomachs as full as they will hold. This food is stored up in the body in the form of fat, and is used to build up wings, legs, sucking tubes, etc., when the caterpillar turns into a butterfly or moth later on.

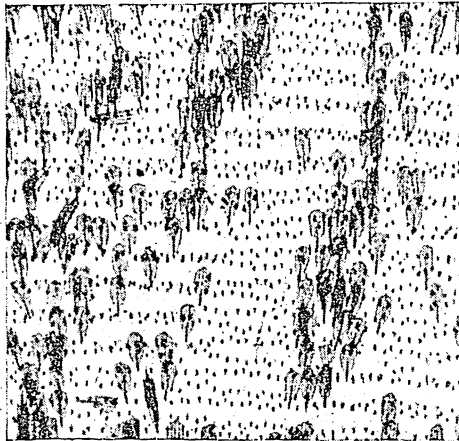
When the caterpillar feels within itself that the time has come for it to turn into a butterfly, it spins a button of silk, to which it clings. Hanging head down, it sheds its caterpillar skin, and then appears in compact form, a naked pupa called a chrysalis, which clings to the button of silk by a sharp spine at the end of the body. Some species spin a halter of silk as well as a button and thus suspend the middle of the chrysalis. The caterpillars of the moths spin themselves cocoons for the pupal stage.

For some time (weeks or months) the pupa or chrysalis sleeps, and during its sleep it changes until it finally comes out a full-grown insect. When it emerges from the cocoon or from the chrysalid skin, it sits still for hours to let its thin, moist, crumpled wings spread out. Then it waves them backward and forward slowly to dry them, and finally flies away in search of nectar-filled flowers and its mate.

Among the butterflies of the United States the tiger swallow-tailed butterfly is one of the largest and most beautiful. The common small yellow butterflies that one sees about roadsides are the roadside species and in cabbage patches the white species is called the cabbage butterfly. Some of the butterflies, like the "mourning cloak," live through the winter under leaves or in sheltered places. They may often be seen flying about during some of the very warm days during thaws.

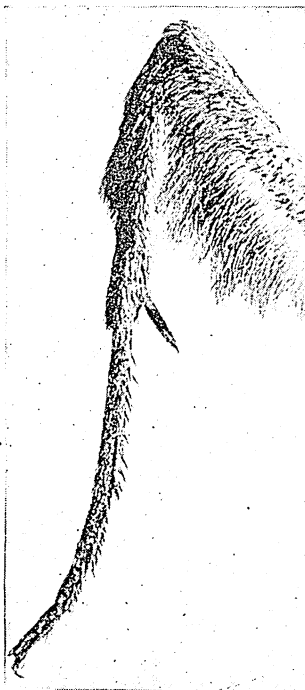
Many of the butterflies and moths which live in tropical countries are brilliant in color and very large. Some of the biggest of these measure as much as eight inches from tip to tip of the spread wings. and are as large as or larger than our winter wren. Some butterflies are shaped and colored so as to

THE "MOSAICS" ON THE LITTLE WINGS



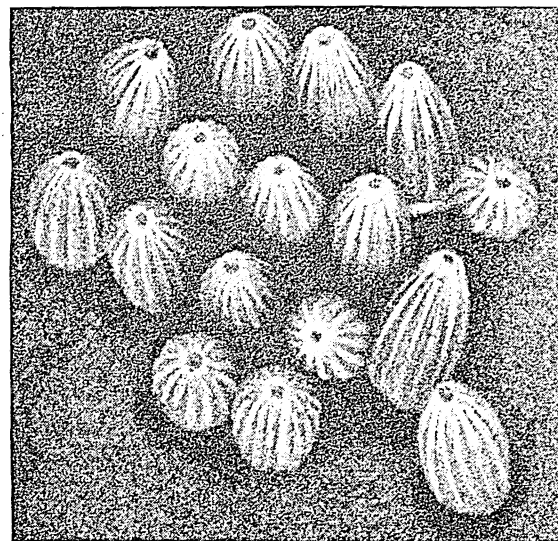
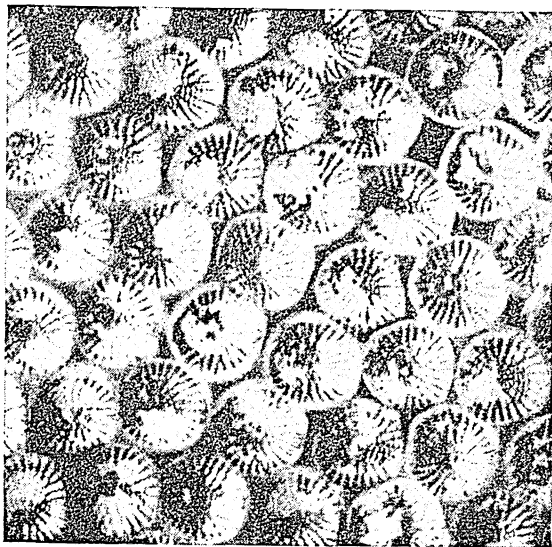
The designs on the wings of butterflies and moths are made with little scales arranged in patterns. This highly magnified picture shows how the scales are set into the wing.

A MOTH'S LEG

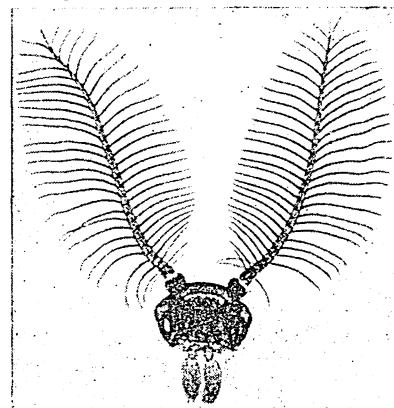
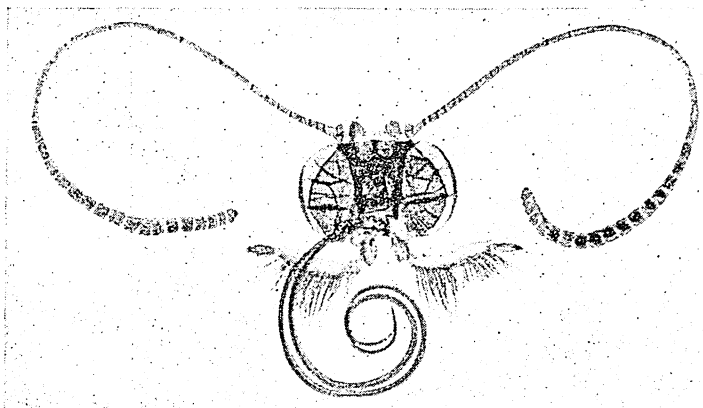


Moths have scales on the lower part of their legs and long silky hairs on the upper part.

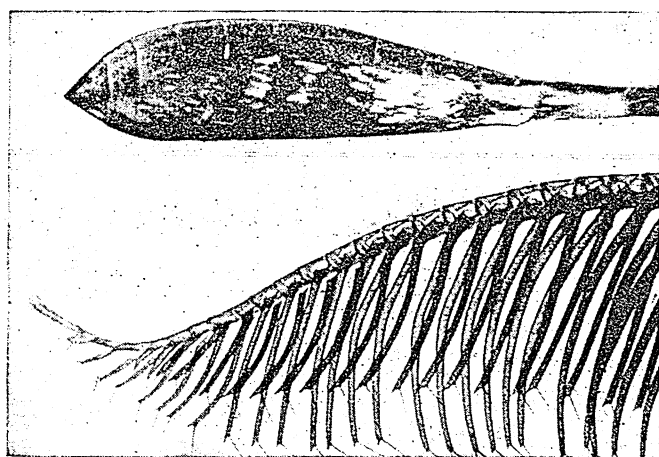
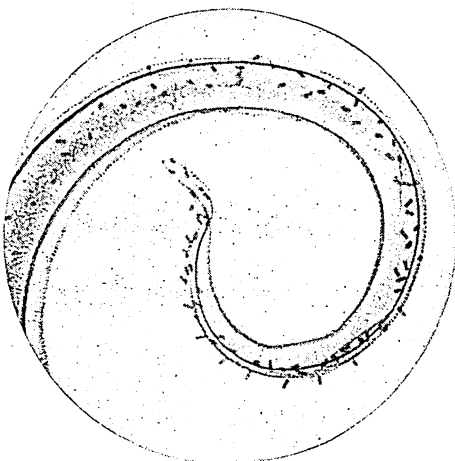
MARVELS OF BUTTERFLY AND MOTH LIFE UNDER THE MICROSCOPE



The eggs of many butterflies and moths show beautiful designs and patterns under the microscope. The cluster of eggs at the left was laid on a leaf by a brocade moth. The photograph shows them magnified about 100 times. At the right, similarly magnified, are some eggs laid on a cabbage leaf by a cabbage butterfly.



This butterfly's head, at the left, is magnified about four times. Above the large compound eyes grow the antennae; underneath we see the curling proboscis, which is used as a tongue, and the two *palpi*, or lips. At the right is a moth's head.

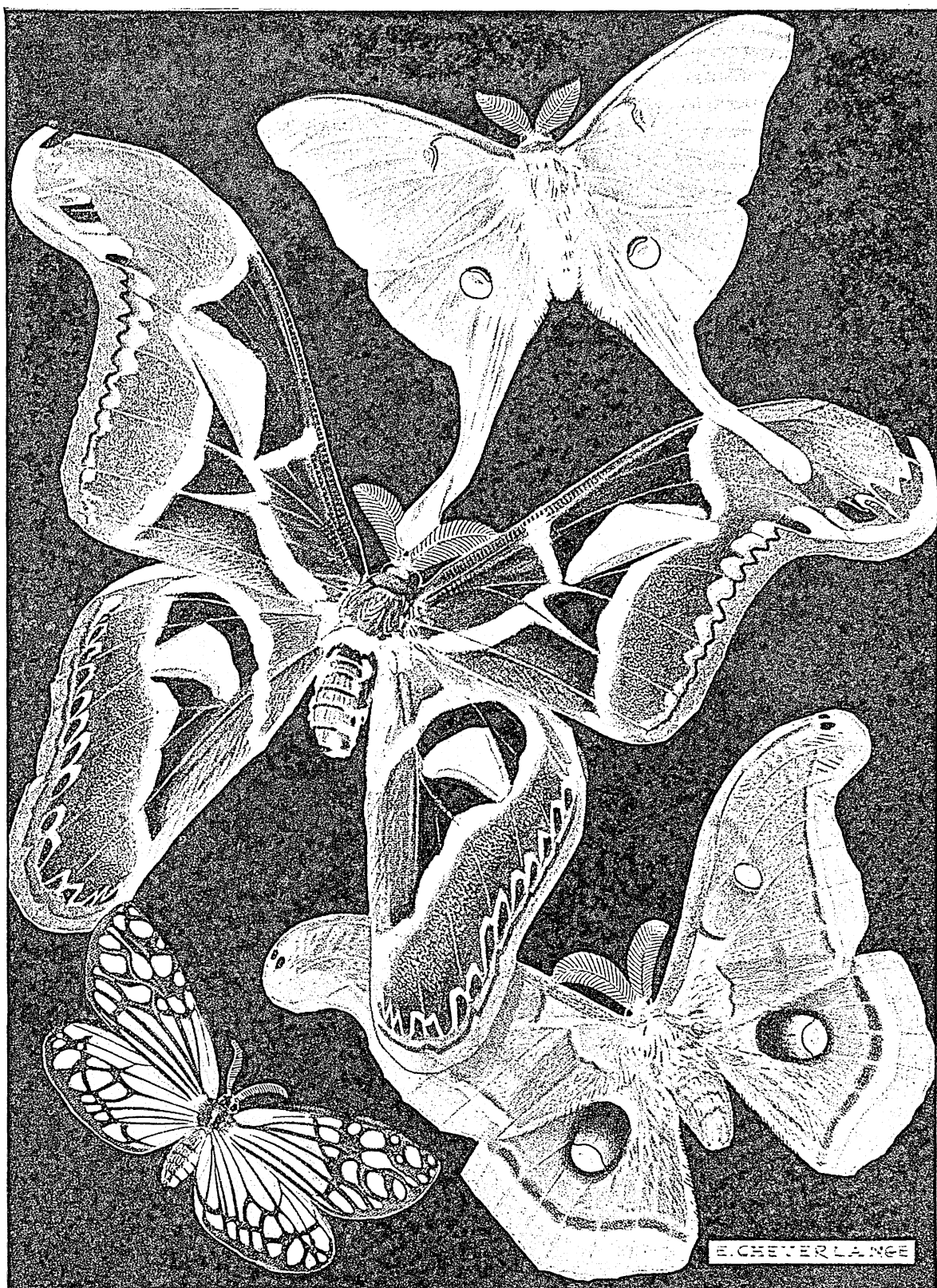


A moth's tongue under the microscope looks like the picture on the left. The dark spots and the little projections are probably taste organs. The upper of the two pictures on the right shows the end of a butterfly's antenna. Compare this with the antenna of the tussock moth below. Nearly all moths have feathery antennae like this, whereas butterflies have smooth club-shaped antennae.

A detailed black and white illustration of six different moths and butterflies, numbered 1 through 6. The insects are shown in various poses, some resting on leaves. The illustration is signed 'J. H. H. 1914' in the bottom right corner.

giant from the Himalayan forests, and *Campylotes splendida* (4) from the Naga Hills of eastern Bengal. All four moths are painted life-size.

THE tribe of moths far outnumbers the butterflies, and it has members that equal the most gorgeous butterflies in the color and pattern of their wings. But, because most moths avoid flying abroad during the brightest hours of the day, their dress is less noticed. On the opposite page are shown four typical moths which can be identified through the small key-picture at the left. Two are native Americans—the Luna moth, *Actias luna* (1), and the Polyphemus moth, *Telea polyphemus* (3), a relative of the silk moth. The other two are from Asia and have no popular English names—*Attacus edwardsi* (2), a



Painting by Elie Cheverlange

See text on opposite page

AMERICAN AND ASIATIC MOTHS

resemble parts of the plants on which they rest. The dead leaf butterfly of India, when perching on a twig with its wings closed, looks almost exactly like a dead leaf. This is to hide the creature and to protect it from its bird enemies.

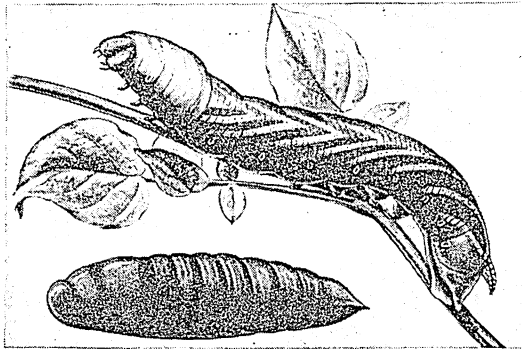
Among the best-known moths are the silkworms, whose cocoons supply the silk of commerce. The caterpillars of some of the smaller forms of moths are very destructive to furs, woolen cloths, and other fabrics. Many larvae are destructive to crops and trees, annually causing great loss. The army-worm, cotton-worm, tobacco-worm, cut-worms, and tent-caterpillars are larvae of moths; the codlin-moth, sphinx-moth, grape-berry-moth, grape-leaf-folder, plume-moth, tussock-moth, and others work much ruin.

The sphinxes or hawk-moths are very beautiful, but many of them are also very baneful. They are large and narrow-winged, visit flowers at dusk and frequently are mistaken for humming-birds. One member of the group is called the "death's head" moth, from the pale yellow markings on the thorax which look like a skull. The larvae of some forms, which are very large, work much havoc on the grape-vine, feeding upon the leaves; it is said that a single larva may strip or kill a small grape-vine in two or three days. The moths appear in July, laying their eggs underneath grape-leaf or leaf of Virginia creeper. The plume-moth is another enemy of the grape. Often one sees young grape-leaves curled up in little balls, examination of which will disclose the greenish-yellow larvae of the plume-moth. The vines should be examined daily, and the larvae picked off and destroyed.

The white-marked tussock-moth works much ruin on shade and fruit trees, stripping them of foliage. There are two broods a year. The cocoons are made in the trees, and the eggs are laid in a white frothy mass. These eggs are conspicuous, and should be destroyed. The gipsy-moth, introduced from Europe in 1869, has done enormous damage to the trees of New England, as has also its near relative, the brown-tailed moth. State and national governments have spent millions of dollars fighting these insect pests.

BUTTERNUT. This native American tree, sometimes called the white walnut, bears an oblong nut covered with a thin husk or hull and having a sweet oily kernel which is very palatable. The half-grown fruit is often used also for pickling. Little attention is paid to the cultivation of the butternut though the wood is most beautifully grained and firm, and is valuable for cabinet making and gun-stocks. From the bark and hulls of the nuts is obtained a dark brown dye. The tree has numerous spreading branches and smooth ash-colored bark. It is rather small, seldom attaining a height of more than 50 feet. The fruit is ripened in September and October. Scientific name, *Juglans cinerea*.

WHEN THE "WORM" TURNS



Caterpillars of the Hawk-moth group can be recognized by the horn at the hind end of the body. This particular caterpillar, a European species, after retiring into the pupal stage shown below, will transform into a "Death's Head" Moth, whose thorax bears skull-like markings.

BUTTONS. We count the buttons on our coats to the old rhyme—

Rich man, poor man, beggarman, thief,
Doctor, lawyer, merchant, chief.

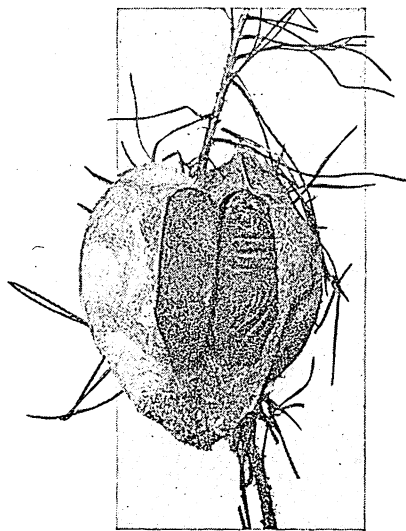
Even though the fortune which they foretell may not come true, buttons are nevertheless a very interesting subject for study.

In early times, clothes were fastened with pins, brooches, buckles, ties, and sashes or girdles. But as early as the 15th century it appears that someone discovered that a loop slipped over a button, or a button pushed through a slit in the cloth, would make a good clothes fastener. Buttons were also worn as ornaments, and those desiring to be dressed in the extreme of fashion would display a wealth of buttons sewed on their clothes, without regard to usefulness. For this reason some religious bodies, such as the stricter Mennonites in Pennsylvania and elsewhere, still forbid the wearing of buttons, and allow only hooks and eyes on the garments of their members.

Some buttons which seem only put on for ornament once had a

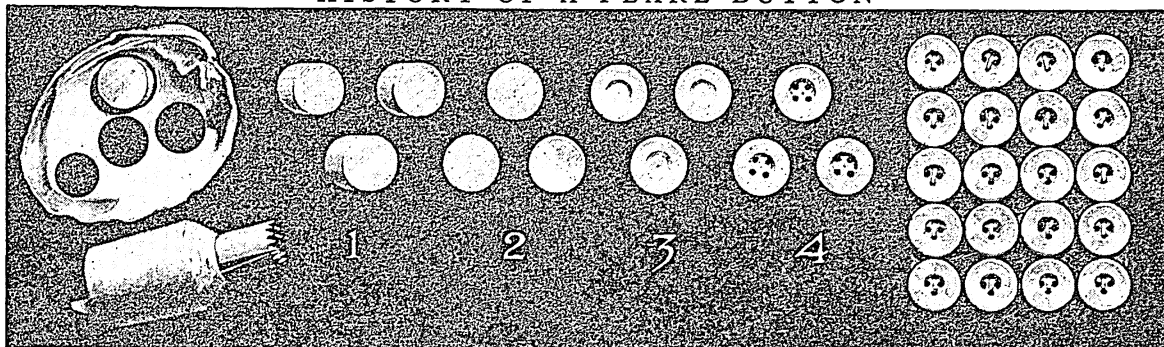
very definite use. This is true of the buttons on men's coat sleeves, which were once used to button back the sleeves to leave the hands free; and those at the back of the frock-coat, which were used to fasten up the long skirts of the coat when riding horseback.

Buttons at first were very expensive. They were often made of gold, silver, or pearl, ornamented by designs and inlaid with precious metals and jewels.



Here we see the construction of the silken cocoon which protects the pupa of most moths from the cold and enemies, and also attaches it to its resting place. The cocoon has been opened to show the pupa inside.

HISTORY OF A PEARL BUTTON



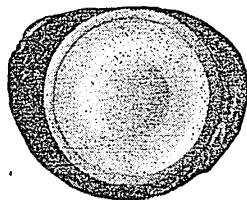
The first thing in making shell buttons is to cut out what are called blanks by means of a tooth die which is fastened into a machine and comes down on the shell with a pressure and a twist, just as mother does when she cuts out cookies. Here we see three of the blanks (1), just as they are cut out, next (2) the blanks are ground down; then (3) a little pit is ground into the center; after which (4) the holes are drilled and the buttons sewed on cards.

They had to be shaped and decorated by skilled tradesmen, working painstakingly on one button at a time. In a modern button factory practically every operation in making many kinds of buttons is done by machines, which are so easily operated that boys and girls can run them. A great variety of materials are used in button-making—fresh-water mussel shells, ocean shells, vegetable ivory, cloth, bone, hoof, horn, brass, iron, steel, glass, agate, celluloid, porcelain, leather, paper board, and various kinds of composition.

In the United States the button industry has an annual output of over \$30,000,000. It centers in six states—New York, Iowa, New Jersey, Pennsylvania, Connecticut, and Illinois. New York leads with more factories than the next three states put together.

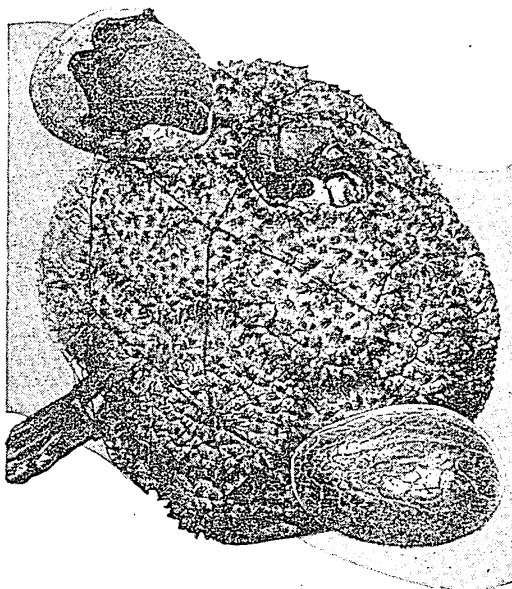
Where Our Pearl Buttons Come From

Fresh-water pearl buttons, made chiefly from the mussel shells of the Mississippi River, are the most important class, both in quantity and value, produced in the United States. With proper attention the supply of these shells will endure indefinitely. Their manufacture was established in 1890, before which most of the pearl buttons in this country were imported from Austria-Hungary and Germany. Within 25 years the



The nuts are sawed into thin pieces and a button is cut inside each piece.

THE IVORY THAT GROWS ON TREES

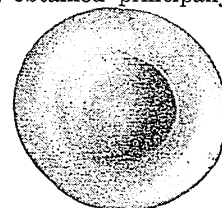


This is a burr containing the nuts from which buttons of "vegetable ivory" are made. These burrs which are the fruit of the Ivory Palm, are as large as a man's head. One of the nuts is shown at the right.

imported article had been practically eliminated from the American market. Iowa leads the states in the production of fresh-water pearl buttons, usually providing more than half the country's total, Muscatine being the center of production. New York and New Jersey also manufacture fresh-water buttons, and they are the chief producers of ocean pearl buttons.

Ocean pearl buttons are made chiefly from the white shell from West Australia, the yellow shell from Manila, and the black shell from Tahiti. These buttons are used principally on better grade shirts, shirt-waists, skirts and dresses, and underwear, while the fresh-water buttons are used on medium and cheaper grades. Machines cut out the button pieces from the shell with tubular saws, split them into discs, drill the holes for fastening the buttons, and smooth and polish them—all with practically no hand labor.

Vegetable ivory buttons are the next in importance. They are made from *tagua* (also called *corozo*) nuts, obtained principally in Ecuador, Colombia, and Panama. The nuts, which are covered with a hard shell, grow in heads of 10 to 30 together, and vary in size from a hickory nut to a large horse-chestnut, the smaller varieties having the finer texture. The seeds of the *palma dum* growing in



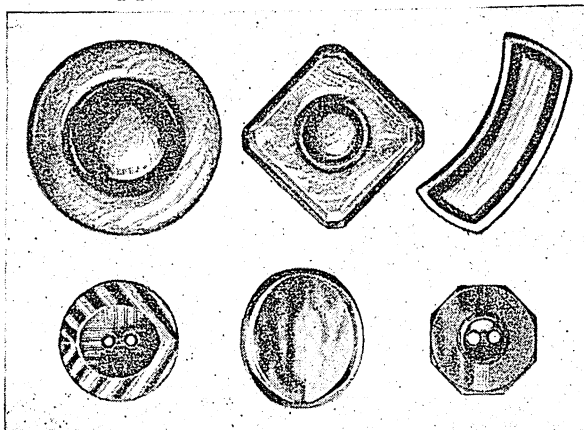
Then the waste material is removed, as shown here, and the "blank" is ready for drilling.

upper Egypt are used to some extent as a substitute for the tagua nut by Italian manufacturers, but these are said to be less satisfactory than the South American product. The tagua nuts are dried from three to six weeks, the hard shells removed in revolving drums, the nuts cut into slabs, and after a moist bath to prevent cracking they are turned on lathes into button blanks. They are then shaped, drilled, and polished somewhat like the shell buttons. They absorb coloring matter readily and so can be dyed to match or contrast with various materials. Thousands of tons of tagua nuts are imported into the United States every year, and from them are made several million gross of buttons. The chief manufacturing centers for ivory buttons are Rochester and Brooklyn, N. Y., Newark, N. J., and Springfield, Mass. Most of the output is bought by the clothing trade for use on

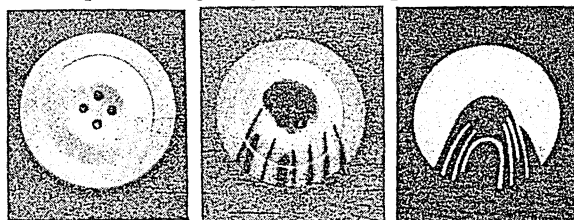
furnish the great bulk of the material used in their manufacture. They are used mainly for underwear, waists, and children's clothing. Cloth and silk buttons are made by covering wooden forms or metal discs. The work of covering is now done by machinery.

Glass buttons are made in infinite variety and color, and there is no limit to the patterns that can be produced. They are chiefly of the novelty type, and the nearest to a standard is the jet glass button. Bohemia has been the home of the glass button industry for many generations, and the skilled workmen guard the secrets of the trade, which have been handed down from father to son ever since the industry was started.

TYPES OF FANCY BUTTONS



Button manufacturers, like the manufacturers of the clothes on which the buttons are to go, exercise their artistic ingenuity in constantly devising new and attractive forms. Here are six examples. Some of the "art" buttons are very expensive.



A "blank" button is dyed in colors by being first sprayed with shellac through a sort of stencil, giving it the appearance of the middle picture. Then it is covered with a dye-chart, such as



that shown at the right, and sprayed with the coloring matter. Then it is placed in a "color bath," which develops the dye, and the shellac is removed, leaving the parts beneath it white.

men's and boys' coats, vests, trousers, and overcoats, and on women's suits and coats.

A large proportion of the manufacturers of metal buttons receive their metal prepared in sheets ready for cutting into blanks. Power presses cut blanks for fronts and backs. Patterns are then stamped on them and the buttons are assembled and polished. There are also cast-metal buttons made by pouring molten metal into molds of different sizes and designs. Various patent buttons are made which do not have to be sewed on. They are usually in two pieces, with a shank on one piece which goes through the cloth and fastens by means of a spring clip in the other half on the other side of the cloth.

Bone buttons are made from the shin bones of cattle. In the United States the packing houses

The ordinary shoe button is made of papier-mâché. In the process of manufacture the buttons are saturated with linseed oil or amber varnish, to give greater firmness; they are then dried, again coated with hot amber varnish, and baked. In finishing they are polished with pumice, given the desired coating of color, dried and again coated; and this process is repeated for three or more coats.

BUZZARD. A familiar sight in southern and western skies is the turkey buzzard, soaring in great circles on wide-stretched, motionless wings. In long slants it sweeps downward, to land clumsily beside some carcass—a dog or a cat in a city street, a steer on the plains, dead fish on a river bank. Farmers and cattlemen value its services in promptly disposing of decaying flesh.

It is a beautiful bird on the wing, but one of the ugliest on the ground. As its claws are not adapted to carrying prey, it feeds where the carcass falls, its bald red head plunged into the carrion. This bald head is more readily cleansed than a feathered head would be. The black-feathered body is about two and one-half feet long, with a wing-spread of six feet.

The black buzzard is a smaller relative of the turkey buzzard; it is more common in cities and on the Atlantic and Gulf coasts, but less common in the interior.

Although these are the most familiar "buzzards" in the United States, they are not true buzzards at all, but vultures. The birds properly called "buzzards" are hawks of the genus *Buteo*, including the red-tailed, red-shouldered, broad-winged, and rough-legged hawks. Europe has two species, the common and the rough-legged buzzards. The term is also loosely applied to related genera of kites, ospreys, and harriers, such as the marsh hawks. (See Hawk; Vulture.)

BYRD, RICHARD EVELYN (born 1888). A boy of 12 set out from Richmond, Va., in 1901, and went around the world alone. By 1935 he had flown over the North and the South Poles, and had mapped some 450,000 square miles of hitherto unknown lands in Antarctica.

This explorer, son and namesake of Richard Evelyn Byrd, an attorney, was born in Winchester, Va. He was graduated from the Naval Academy in 1912. He trained as a World War air pilot in 1917, and commanded the United States Naval Aviation Force in Canada from July 1918 until the Armistice.

In 1925 Byrd went as flight commander with the Navy-MacMillan expedition to Greenland. On May 9, 1926, with Floyd Bennett as pilot, he achieved the first flight ever made by airplane to the North Pole.

In 1927 Byrd, with three friends, flew 4,200 miles across the Atlantic in 43 hours. Their monoplane *America*, on July 1, was forced down upon the sea off France at Ver-sur-Mer, the very spot where Byrd's Norman ancestor, one LeBrid, had landed in 1540.

But it was in Antarctica that Byrd proved himself to be one of the great explorers of modern times. In two expeditions, planned with infinite study, he and his men uncovered more secrets of scientific value than had all previous explorers of Antarctica (see Antarctic Continent). His methods and discoveries are described in the article Polar Exploration.

On the expedition of 1928-30, he claimed a vast territory for the United States, naming it Marie Byrd Land for his wife. Piloted by Bernt Balchen on Nov. 28-29, 1929, he made the first airplane flight to the South Pole. He was made rear admiral in 1930.

In 1933-35 Byrd added some 200,000 square miles to American claims, but nearly lost his life. To study weather, he spent 4½ months, Mar. 28-Aug. 11, 1934, alone in a hut 123 miles south of his base, "Little America," on the Ross Sea. Rescuers found him poisoned by carbon monoxide from a stove. On returning to the United States he became active in peace work.

Byrd's third expedition to the Antarctic (1939-41) was the first to be sponsored by the Federal government. From two bases 1,500 miles apart the expedition discovered and charted 1,100 miles of coast line and an additional 100,000 square miles of surface. Coal, copper, and other mineral deposits were reported.

Thousands have shared Admiral Byrd's adventures by hearing his lectures, illustrated with motion pictures, of his first two Antarctic trips. His books include 'Skyward' (1928); 'Little America' (1930); 'Discovery' (1935); 'Exploring with Byrd' (1937); 'Alone' (1938).

BYRON, GEORGE GORDON, LORD (1788-1824). Few days in the life of Lord Byron, one of England's greatest poets, were free from pain and sorrow. The misfortune that clouded his whole career was a lameness resulting, some surmise, from an attack of infantile paralysis. Unlike the sweet-tempered Sir Walter Scott, who also was lame, Byron brooded on his infirmity until it poisoned his whole existence.

"What a pretty boy Byron is!" a friend of his nurse once thoughtlessly remarked in his presence. "What a pity he has such a leg!"

Like a flash the child turned and slashed her with his toy whip, crying passionately in the Scotch dialect of his boyhood: "Dinna speak of it!"

This was Byron's attitude through life; he was always assailing the world for some real or fancied grievance. In most of his work we see a scowling brow and a curling lip. When his first volume of poems—published at the age of 19—was severely criticized by a reviewer, Byron ferociously attacked not only his critic but the whole generation of literary men, in 'English Bards and Scotch Reviewers,' one of the most scathing satires in English.

After a tour of Spain, Greece, Turkey, and other lands, Byron published the first two cantos of 'Childe Harold's Pilgrimage,' and, to use his own words, "awoke one morning to find himself famous." He became the hero of the hour. Women worshiped him, and young men imitated him by wearing the open collar and flowing tie which the poet affected, and posed as melancholy romantic heroes, like those whom Byron pictures. On the Continent he was hailed as second only to Shakespeare.

But Byron's personal popularity soon ended. When his wife left him a year after their marriage, society turned against him, and Byron, disappointed and embittered, left England, never to return.

"Nothing in his life became him like the leaving of it." Byron's death was such as he would have chosen for himself. He gave his life on the altar of freedom, dying of a fever while serving in the war of Greek independence against Turkey.

Byron passed judgment on himself when he wrote of one of his heroes:

This should have been a noble creature: he
Hath all the energy which would have made
A goodly frame of glorious elements,
Had they been wisely mingled; as it is,
It is an awful chaos—light and darkness,
And wind and dust, and passions and pure thoughts
Mixed, and contending without end or order.

Byron's chief works are: 'Hours of Idleness' (1807); 'English Bards and Scotch Reviewers' (1809); 'Childe Harold's Pilgrimage' (1812-18); 'The Giaour' (1813); 'The Bride of Abydos' (1813); 'The Corsair' (1814); 'Lara' (1814); 'Manfred' (1817); 'Don Juan' (1819-24); 'Cain' (1821).

BYZAN'TINE EMPIRE. The Byzantine Empire was the strange oriental after-glow of the sinking Roman Empire. Too vast to be governed and defended from a single capital, the empire gradually split into a western half and an eastern half. As the West declined, the East grew stronger, until finally in 330 A.D. Constantine the Great decided to remove his capital from Rome. He did this, partly to obtain a better base for defense against attacks from Asiatic foes, partly because Rome was the stronghold of the ancient pagan faith, and Constantine had wit enough to see that the future lay with the new Christian religion. (See Constantine.)

For his capital Constantine chose Byzantium, which he rebuilt, fortified, and renamed Constantinople. He said that his choice of the city was revealed

to him in a dream. It proved a most practical dream.

The narrow straits of the Dardanelles could be rendered impassable to a hostile fleet, and the forts of the landward side were built so strong that a small force could hold them against a very large one. Weak, idle, and dissolute as the people became, their city was so strong that the Byzantine, or Eastern, Empire survived for a thousand years after Constantine, long after the Western Roman Empire had crumbled away. Roman law and many of the ancient Roman traditions persisted in the East, though Latin soon gave place to Greek as the popular tongue, and life and art became more and more oriental in tone.

The World's Debt to the Byzantines

It is precisely for its preservation of the civilization of Rome and Greece, and for its service as a bulwark against invasion from Asia, that the Byzantine Empire did a work of incalculable value. To be sure, the scholars of Constantinople were so dazzled by the wealth of learning they had inherited that they did little with it except study it and compile books of extracts or summaries.

Most useful of these compilations was the famous Justinian Code of Roman law, made by scholars under the emperor Justinian, who with his beautiful actress-wife, Theodora, ruled the Byzantine Empire from 527 to 565, the period of its greatest glory. (See Justinian.) At this time the empire extended from southern Spain to the valley of the Tigris and Euphrates, and from the Danube River to upper Egypt.

The wise Justinian was a contrast to the foolish, pleasure-craving, splendor-intoxicated people he ruled. Yet how they must have loved their gorgeous and lively city! In its streets guards with golden spearheads jostled a cosmopolitan crowd—Bulgarians in baggy trousers and big turbans; cruel, cat-faced Huns; and Persians nodding their tall sheepskin caps. Beautiful things from many lands filled the shops: silk, purple cloth and gold from Greece; spices, drugs, and precious stones from India; silks from Arabia; fur, honey, and wax from Russia; and the beautiful jewelry, gold brocades, carved ivories, and rich embroideries of Constantinople itself.

In Justinian's glowing church of Santa Sophia the sunlight poured down from 40 windows of the great dome, washing in golden light the gold mosaics with their bright-colored saints, the columns of jasper, marble, alabaster, and porphyry, and the designs of mother-of-pearl. Court life was ceremonious and gorgeous. A visitor to Constantine VII in 948 found the emperor seated on his throne before a golden plane-tree full of artificial birds which burst into song, while two golden lions on each side of the throne began to roar. The startled visitor touched the floor thrice with his forehead, and arose to find that the emperor, throne and all, had been hoisted to the roof!

Heart of the life of Constantinople, however, was the Hippodrome, where 30,000 people sat under awn-

ings of silk and purple to watch the chariot races and to enjoy the triumphal processions of victorious generals, who distributed to the crowd loot taken from the Vandals—golden girdles, silver vases, gems and dishes and garments. The Empress Theodora in her youth performed in this circus. A one-eyed yellow dog was equally famous as an entertainer, since he could sort out a pile of rings and return each to its owner. The childish mobs divided so hotly in their enthusiasm for rival groups of charioteers that in their strife they once burned the best part of the city and nearly cost Justinian his throne.

Yet this was the nation which led the world in art, so that its bulbous domes and glittering mosaics are to be seen in Santa Maria Maggiore in Rome, in San Vitale and San Apollinari in Ravenna, in the mosque of Cordova, Spain, and in the famous St. Mark's Cathedral in Venice. The latter contains one of the most remarkable examples of the goldsmith's art in the world, the Pala d'Oro, a great Byzantine reredos with 24 figures in enamel against a background of gold and big uncut precious stones.

Sacred Images and the Iconoclasts

One feature of Byzantine art is its lack of statuary. The early Christians disapproved of it because they feared the Christian church would fall into the old pagan worship of images. The Arabs, always in close touch with the Byzantine world, held the same views. After a time, however, the clever hands of Byzantine artists were carving ivory bas-reliefs of the saints, or making icons—gilded and painted religious pictures. The emperor Leo III in 726 began a campaign to abolish these images, and his adherents, who smashed the sacred pictures, were called "iconoclasts" or image-breakers. So serious was the strife over images that it was an important factor in bringing about the division between the east and west branches of the church. (See Church, Christian.)

Constantinople grew more and more oriental in tastes and sympathies, gayer, and also weaker. When the Crusaders came there at the close of the 11th century, they were amazed to find a city of a million people, with paved and lighted streets, great parks, hospitals, theaters, efficient police, fine palaces, and excellent schools.

Yet it was the Fourth Crusade which first brought ruin to Constantinople. In 1204 the Crusaders, at the instance of the jealous Venetians, captured and looted the city. Many great art works of the past were destroyed, and the famous bronze horses were carried off to St. Mark's in Venice.

A ghost of the Byzantine Empire survived for a time, until in 1453 the fierce Ottoman Turks closed in on the doomed city of Constantinople, killed the emperor Constantine XIII, plundered, murdered, and took slaves. Since then (until 1923) the city has been the Turkish capital and the crescent has replaced the cross over Santa Sophia. (See Istanbul.)

THE EASY REFERENCE FACT-INDEX

GUIDE TO ALL VOLUMES FOR SUBJECTS
BEGINNING WITH

B

TO SAVE TIME

USE THIS INDEX 

EDITOR'S NOTE ON NEXT PAGE TELLS WHY

SPECIAL LISTS AND TABLES

| | | |
|---------------------|-----------|-------|
| IMPORTANT BATTLES | | 307-8 |
| SOME FAMOUS BRIDGES | | 342 |
| BYZANTINE RULERS | | 354 |

Numerous other lists and tables in the fields of geography, history, literature, science, mathematics, and other departments of knowledge will be found with their appropriate articles in the main text

EDITOR'S NOTE

EVERY user of Compton's Pictured Encyclopedia should form the habit of *first* turning to the Fact-Index section at the end of each volume when in search of specific information. This index is a miniature work of reference in itself and will often give you directly the facts, dates, or definitions you seek. Even when you want full treatment of a subject, you will usually save time by finding in the index the exact page numbers for the desired material.

All page numbers are preceded by a letter of the alphabet, as A-23. The letter indicates the volume. If two or three page numbers are given for the topic you are seeking, the first indicates the more general and important treatment; the second and third point to additional information on other pages. Where necessary, subheadings follow the entry and tell you by guide words or phrases where the various aspects of the subject are treated.

The arrangement of subheadings is alphabetical, except in major historical and biographical entries. In these the chronological order is followed.

The pictures illustrating a specific subject as a rule appear on the same pages as the text to which you are referred. But often illustrations placed elsewhere will prove of additional interest and value. These are indicated by the word *picture* followed by a page number.

A picture reference is frequently intended to call attention to details in the text under the illustration as well as to the illustration itself. This picture-text, therefore, should always be carefully read.

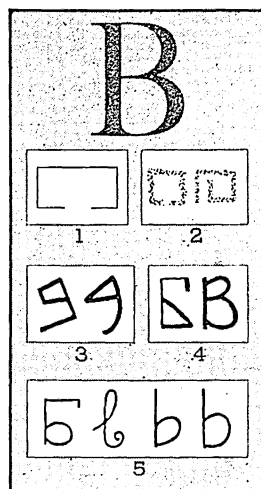
The pronunciations given are those preferred by the best and most recent authorities; alternative pronunciations are indicated only where usage is equally divided. For foreign names the native pronunciation is given except where the English pronunciation has become thoroughly established, as in "Paris," "Barcelona," "Seine."

In recent years hundreds of foreign geographical names have been changed, either officially or by custom. Both old and new names are given at the appropriate places in the alphabet.

Populations are given in round numbers, except for places in the United States and Canada, where the figures are those of the latest official census. Distances between points are map or air distances, not distances by railroad.

THE EASY REFERENCE FACT-INDEX

Reg. U. S. Pat. Off.



OUR LETTER B probably started in Egyptian writing as a picture sign for 'house' (1). Shortly after 2000 B.C., a Semitic people called the Seirites adopted this picture as an alphabetic sign for the sound of 'b', because the Semitic word *beth*, meaning 'house', began with this sound.

The Seiritic sign was crudely made (2); but the Canaanite-Phoenician alphabet gave it a better shape, with a tail (3). In Hebrew, and probably in other Semitic languages, the sign was called *beth*.

When the Greeks learned to write from the Phoenicians, they changed the name of the letter to *beta*. Later, when they began to write from left to right, instead of from right to left, they turned the letter around. They also gave it graceful curves (4). The Romans took this curved form into Latin, and from Latin the capital letter came to us without change.

Our present small 'b' began to take shape in later Roman times when writers fell into the practise of omitting the upper loop of the capital or making it long and thin (5). By the 9th century the letter had its present form.

NOTE.—For the story of how alphabetic writing began and developed, see the articles Alphabet; Writing.

'Baa Baa Black Sheep', story by Kipling K-24

Baader (*bü'dër*), Benedict Franz Xaver von (1765-1841), German philosopher and speculative theologian of Roman Catholic church, born Munich; practised medicine and engineering; professor theology University of Munich.

Baal (*bā'āl*), Semitic name for a lord, master, or god; especially, sun-god of Canaanites and Phoenicians.

Baalbek (*bāl-bēk'*), Syria, village 35 mi. n.w. of Damascus, famous for splendid Roman ruins; once finest of Syrian cities; probably an early seat of Baal or sun-god worship; called Heliopolis by Greeks.

Baalzebub. See in *Index* Beelzebub

Baba Cape, or Cape Lectum, in the Troad, westernmost point of Asia Minor.

Babako'to, or indri, a lemur L-94

Babassu (*bā-bā-sq'*) nut, hard-shelled Brazilian nut valued for its oil; obtained from a palm of the genus *Attalea*, related to coconut: N-188 palm, picture S-208i

Babbage, Charles (1792-1871), English mathematician, prolific writer and influential teacher calculating machine C-20

Babbitt, George Follansbee, character in Sinclair Lewis' novel 'Babbitt'; represents one type of successful American businessman.

Babbitt, Irving (1865-1933), American scholar and critic; born Dayton, Ohio; professor of French literature at Harvard 1912-33; foe of naturalism; exponent of the classical formula of moderation and form; a leader of the humanist movement in America: A-183

Babbitt, Isaac (1799-1862), American inventor, born Taunton, Mass.; made first Britannia ware (1824) in U. S.; invented babbitt metal.

Babbitt metal, a soft alloy of tin, copper, and antimony A-132

Babcock, Alphaeus, improves piano P-211

Babcock, Stephen Moulton (1843-1931), American educator and agricultural chemist, born Bridgewater,

N. Y.; educated at Tufts College, Cornell University, and University of Göttingen, Germany; on faculty at Cornell and Wisconsin; did notable work in chemistry of milk; devised Babcock milk test, which he gave to the world, refusing to patent it for private gain.

Babcock test D-2, W-124

Babe the Blue Ox, in Paul Bunyan tales B-276

Babel (*bāb'ēl*), Isaac Emanuilovich (born 1894), Russian short-story writer, born in Odessa of Jewish family; joined Cossacks and wrote of his experiences in 'Stories of the Red Cavalry': R-197

Babel (*bāb'ēl*), Tower of, built by Noah's descendants as safeguard against future floods; during construction occurred the "confusion of tongues" (Gen. xi) in Babylon: B-5

Bab el Mandeb (*bāb ēl mām'dēb*) (Arabic for "Gate of Tears"), strait between Arabia and Africa at s. end of Red Sea; 20 mi. across; named from danger of navigation: map A-242

Baber (*bā'bēr*) (1483-1530), founder of Mogul (Mongol) Empire in India M-224, I-38

'**Babes in the Wood**', an old ballad which describes two little children who were left in the woods to perish; origin unknown.

Bab'ington, Anthony (1561-86), page to Mary, Queen of Scots; executed for conspiracy to murder Elizabeth.

Babirussa (*bāb-i-rū'sā*), or pig deer, long-tusked wild swine found on the Island of Celebes.

Babism. See in *Index* Bahaism

Babol, also Barfrush, a trading town, cap. of Mazanderan province in n. Persia, 12 mi. from Caspian Sea; pop. 30,000; rice, cotton, silk: map A-332b

Baboons, or dog-headed monkeys M-230, picture M-229 altitude range, picture Z-228 hand, picture A-225

Babrius (*bā'bri-ūs*) (first cent. A.D.), collector of Aesop's fables A-28

Babson, Roger W. (born 1875), American statistician, born Gloucester,

Mass.; founded statistical organization with branch offices in largest American cities; nominated for U. S. President by Prohibition Party 1940 ('Business Barometers'; 'The Future Method of Investing Money'; 'A Business Man's Creed').

Baby blue-eyes. See in *Index* Nymphila

Baby care B-1-4. See also in *Index* Child development

articles needed for new baby B-4

bathing B-1, 2

bowel and bladder control B-3

child's needs come first B-3

feeding B-1-2

play, exercise, and clothing B-3

psycho-physical development B-3-4

sleep B-1, 2-3

walking B-3

weaning B-2

weight B-2

Babylon (*bāb'i-lōn*), cap. of ancient Babylonia, on Euphrates River 70 mi. s. of Baghdad: B-4, maps E-204, B-8. See also in *Index* Babylonia and Assyria

Hanging Gardens B-4, S-81-2, picture S-83

Nebuchadnezzar enlarges B-8

paved streets R-111

'**Babylon, How Many Miles to?**' game P-251, picture P-251

Babylonia and Assyria, ancient empires of Tigris-Euphrates valley including Chaldean, or Second Babylonian Empire B-5-10, maps B-8, E-204, Outline A-192-3. See also in *Index* Assyrian Empire; Babylon agriculture A-58

architecture A-257-8, B-4, 8

arch used A-249, A-257

Assyrian palace, picture B-5

bricks used B-236

Chaldean period: Hanging Gardens of Babylon S-81-2, picture S-83; temple at Kish, picture A-258; temple at Ur, picture A-3

astronomy B-8, picture E-129

counting system N-184

enameling E-263

excavations B-4: at Nineveh N-146 government D-45

history B-5-9, chart H-297-8

Israel conquered J-216

Median invasion M-107, B-8

Nineveh B-8, N-146

Chaldean, or Second Babylonian Empire B-8
 Babylonian captivity of Jews J-217
 horse first used T-121
 irrigation canals E-315
 laws, Hammurabi's code B-6: prohibition P-350
 libraries B-8, N-146
 literature B-8
 Mesopotamia M-120-1
 myths B-9-10
 painting P-13
 religion B-9, G-125
 sculpture S-53, B-8, *pictures* B-6, S-54, M-121, E-336: Chaldean, *picture* A-250
 7-day week instituted W-65
 slavery S-158
 sundial invented W-35
 Tigris and Euphrates T-93, E-315
 water supplied to cities W-54
 writing B-4, C-413, W-184, 185, *chart* W-185, *pictures* W-184, P-135
 characters W-185
 Hammurabi's letters B-6
 inscriptions discovered A-253
 material and methods B-175

Babylonian captivity
 of Jews J-217
 of popes B-174, P-163, G-177

Baby's breath, common garden flower; name correctly applied only to species of *Gypsophila*; tiny white or pink flowers in clusters; small lance-shaped leaves
 how to plant G-10

Bacchanalia (*băk-ă-nă'li-ă*), Roman festival in honor of Bacchus D-70
 similar Greek festival D-91

Bacchantes (*băk'ăn-têz* or *bă-kăn'têz*), dancing women attending Bacchus D-70

Bacchus (Greek Dionysus), Roman god of wine D-70, D-91

Bach (*băk*), Johann Sebastian (1685-1750), German musician and composer B-10
 analysis of music M-311-12
 music played by Mendelssohn M-114
 wrote for harpsichord and clavichord P-210

Bach, Karl Philipp Emanuel (1714-88), German musician, son of J. S. Bach; court musician to Frederick the Great, 1746-68; later at Hamburg; made use of harmonic color develops sonata M-312

Bacharach, Germany, town on Rhine River 22 mi. s. of Coblenz; 13th-century ruins: *picture* G-74

Bacha Sakao (*bă'chă sūk'ă*), "water boy" who usurped Afghanistan throne and ruled as King Habibullah January-October 1929; captured by Nadir Khan and executed: A-31

Bachelor, John (1817-1906), American inventor, born Weare, N. H.; made many improvements on sewing machine: S-93

Bach'eller, Irving (born 1859), American novelist, born Pierrepont, N. Y.; interpreted American life and character with sympathy and humor; also wrote historical fiction ('Eben Holden'; 'D'ri and I'; 'A Man for the Ages'; 'Silas Strong'; 'Cricket Heron'; 'The House of the Three Ganders'; 'The Master of Chaos').

Bachelor, an unmarried man position in American colonies A-167

Bachelor (degree), academic distinction given by a college or university, usually after four years' study as undergraduate; common form is B.A. or A.B. (Bachelor of Arts); also given in divinity, medicine, law, science, philosophy,

literature: U-257
 origin U-260

Bachelor's button, name applied to several garden plants, especially *Centaurea cyanus*, which has blue, pink, purple, or white flowers; also called cornflower, ragged robin, and bluebottle.

Bacillus (*bă-sil'ūs*), plural bacilli (*bă-sil'i*), rod-shaped bacterium G-78, *pictures* G-78, G-80
 lockjaw, reproduction, *picture* B-12
 reproduction B-13

Back Bay district, Boston B-200

"Back-blocks," or "bush," interior of Australia A-374

Backbone. See in *Index* Spine

Backbone Mountain, highest point in Maryland, 3340 ft.

Backgammon, game played by 2 persons each with 15 pieces or "men" on a board divided into 4 "tables," the moves being determined by dice-throws. Probably of oriental origin; formerly called tables.

Backhaus (*băk'hous*), Wilhelm (born 1884), pianist, born Leipzig, Germany; professor Royal College of Music, Manchester, England 1905; as concert pianist noted for technical skill, brilliance, and poetic feeling.

'Back of the North Wind, At the', story for children by George MacDonald; tells of Lady North Wind's interest in a little boy named Diamond whose acquaintance she made through a knothole in the headboards of his bed.

Back pressure, in electric circuits how generated in cells E-225

Back-swimmer, a water-bug W-46

Bacon, Francis, Baron Verulam and Viscount St. Albans (1561-1626), English philosopher, statesman, and writer B-10-11, E-284

essays E-304
 founded empiricism P-173, P-196
 quoted on gardens G-6

Shakespeare authorship controversy B-11, S-98

Bacon, Henry (1866-1924), American architect, born Watseka, Ill. ('Court of Four Seasons', Panama-Pacific Exposition Building; 'Lincoln Memorial', Washington, D. C.; and many other notable works).

Bacon, Josephine Dodge Daskam (born 1876), American novelist and poet, born Stamford, Conn.; made special study of child life ('Memoirs of a Baby'; 'Biography of a Boy'; 'Counterpoint'; 'The Root and the Flower').

Bacon, Nathaniel (1642?-76), leader of "Bacon's Rebellion" B-11

Bacon, Peggy (born 1895), artist and author, born Ridgefield, Conn., favorite subjects are animals done in humorous fashion ('Lion-Hearted Kitten, and other stories')
 illustration, *picture* S-303p

Bacon, Roger (1214?-94?), English monk, scientist, and author B-11, I-115

forerunner of modern chemists C-178
 knowledge of gunpowder G-188
 theory of telescope T-38

Bacon, a meat obtained from the side of the hog; given pronounced flavor by smoking and curing; ranks next to butter in body fuel value: H-316

Bacon's Rebellion B-11

Bacteria (*băk-tê'ri-ă*), a group of minute parasitic or saprophytic plants related to the fungi B-12-13.

See also in *Index* Germ theory of disease; Parasites; Protozoa

antiseptics A-222-3

antitoxins A-223-4

autotrophic, or self-nourishing B-13

butter making, culture used in D-4

canning destroys C-74-5

cheese ripening C-164, 165

chemical elements distributed B-13

cold checks activity A-223

destroyed by bacteriophage G-80,

P-245d; by leucocytes B-157a

disease caused by G-77-80, M-108

enzymes formed by E-299

fermentation B-12

food poisoning H-373-4

heat, resistance to B-13

industries based on B-13

luminous forms B-13

milk, protection D-4-5

nitrogen fixation N-147-8, S-191a-b,

B-12, P-243-4, *pictures* A-117, C-282

parasitic nature B-114

pasteurization destroys P-86

reproduction B-13, *pictures* B-12

respiration R-79

scavengers B-12

soil making B-12, S-191a-b

test, centrifuge device for C-134

ultra-violet rays destroy R-15

vaccination V-267

yeast-making aided by Y-204-5

Bactericide S-262

Bacteriology B-205

centrifuge device C-134

germ theory of disease G-77-80

Koch G-78

Lister A-222

microscope M-156-8

Pasteur P-86

Bacteriophage (*băk-tê'ri-ô-făj*) (from Greek words meaning "bacterium eater"), a substance or organism, exact nature unknown, which destroys bacteria; first described by F. W. Twort (1915) and F. D'Hérelle (1918): G-80
 in plants P-245d

Bactria, ancient country (modern Balkh, Afghanistan) n. of Hindu Kush Mts.; famous for horses and camels; one of earliest homes of Aryans; conquered by Cyrus the Great and Alexander, after whose death a new Bactrian kingdom extended its rule as far as n. India.

Bactrian camel C-38-9

Bad air, household hygiene H-374

Badajoz (*bă-dă-hôh'*), Spain, historic city on Guadiana River 5 mi. from Portuguese frontier; pop. 43,000; taken by French (1811) and recaptured by British under Wellington (1812): *map* S-226

Bad Ems. See in *Index* Ems

Baden (*bă'dn*), state of s.w. Germany, former grand duchy; 5819 sq. mi.; pop. 2,520,000: B-13, *map* G-66

Black Forest B-153-4

Heidelberg H-270

Ba'den, or **Ba'den-Ba'den**, Germany, health resort in Baden at edge of Black Forest; pop. 30,000; 29 hot medicinal springs.

Baden-Powell, Agnes, national vice-president of Girl Guides; author of *Handbook*; important worker with British Red Cross: G-93

Baden-Powell, Robert S. S. **Baden-Powell**, first Baron (1857-1941), British general; served in India, Afghanistan, and Africa; hero of Boer War (defense of Mafeking) founds Boy Scouts B-217
 founds Girl Scouts G-93

Badger, animal of weasel family B-13-14, *pictures* N-29d, H-289, B-13
 hunted with dachshund D-81

Badger-baiting, an old sport in which trained dogs pulled badgers from barrels or other artificial holes B-13

Badgering, origin of word B-13

Badger State, popular name for Wisconsin W-127

Bad lands, areas in western U. S. where shale and sandstone surface has been eroded, *picture* P-199 Nebraska N-57

North Dakota N-161, *picture* N-162 South Dakota S-218: national monument N-20 Wyoming W-192

Badlands National Monument, in South Dakota N-20

Bad'minton, game similar to lawn tennis but played with shuttlecocks, instead of tennis balls; played both indoors and outdoors; either with two or four players; named for estate of Duke of Beaufort, Gloucester, England; developed from game battledore and shuttlecock

Badnyak, Yugoslav Yule log C-229b

Badoglio (*bā-dōl'yō*), Pietro (born 1871), Italian marshal; distinguished in 1st World War; viceroy of Ethiopia, 1936; chief of general staff 1940; retired after Greek campaign of 1940; succeeded Mussolini as premier July 1943: W-179c

Baeda. *See in Index* Bede

Baedeker (*bā-dē-kēr*), Karl (1801-59), German guide book publisher.

Baekeland (*bā-kē-lānd*), Leo Hendrik (born 1863), American chemist, born at Ghent, Belgium invents bakelite P-245i-j, C-289

Baer (*bēr*), Karl Ernst von (1792-1876), Russian zoölogist, father of embryology Z-227, E-259

Baer, Max (born 1909), American boxer; born Omaha, Neb.; world's heavyweight champion 1934: B-212

Baeyer (*bā-yēr*), Adolf von (1835-1917), German chemist; won Nobel prize in chemistry (1905) makes synthetic indigo I-71

Baffin, William (1584-1622), English navigator and Arctic explorer, discovered Baffin Bay in 1615; name given to Baffin Island; said to have been first to fix longitude at sea by astronomical observation.

Baffin Bay, large gulf of n.e. North America; 800 mi. by 280 mi.: *maps* C-50c, N-150b

Baffin Island, or Baffin Land, Canada, island w. of Greenland; 200,000 sq. mi.: *maps* C-50c, N-150b

Bagan'da, or Waganda, African tribe E-139

Bagasse (*bā-gās*), sugar-cane waste S-320 source of cellulose, *chart* C-123

Bagdad', Iraq. *See in Index* Baghdad

Bagehot (*bāg'ōt*), Walter (1826-77), English economist, political philosopher, and literary critic; editor *Economist*; had wide influence; wrote in vigorous, sparkling style ('Physics and Politics', a novel application of theory of evolution; 'Lombard Street', analysis of English credit system, greatly influenced banking; 'The English Constitution'; 'Literary Studies').

Baggat'away, Indian name for game of lacrosse L-52-3

Baghdad (*bāg-dād*), or Bagdad (*bāg'-dād*), chief city and cap. of Iraq; pop. 360,000; 350 mi. n. of Persian Gulf on Tigris River: B-14-15,

maps A-242, A-332b climate I-123

Kadhimain Mosque, *picture* I-123

Bagley, William Chandler (born 1874), American educator and writer, born Detroit, Mich.; professor of education, 1917-40, emeritus after 1940, Teachers College, Columbia University; prolific writer on education and history ('Craftsmanship in Teaching'; 'The Educative Process').

Bagnell Dam, in Missouri across Osage River in Ozark Mts., 120 mi. s.e. of Kansas City, Mo.; forms Lake of the Ozarks, one of largest artificial lakes in world; electric power generated delivered mostly to St. Louis: *table* D-357

Bagnold, Enid (born 1894?), English author of children's books; 'Alice and Thomas and Jane' and 'National Velvet' reveal a profound understanding of children, combined with a sense of humor.

Bagot, Sir Charles (1781-1843), British statesman, born Rugely, Staffordshire, England; governor general of British North America 1841-43; advocated "responsible government"

Rush-Bagot Treaty G-150

Bagpipe, a wind instrument B-15, *pictures* M-322, H-320

Baguio (*bā-gē-ō*), "summer capital" of Philippine Islands; in mountains in Luzon; 130 mi. n. of Manila; pop. 24,000: *map* A-332c

Baguio (*bā-gyō*), a tropical storm P-165

Baháism (*bā'hā-izm*), a religious movement growing out of Babism, founded in Persia 1844-45 by Mirza Ali Mohammed; he prepared the way for Mirza Hussein Ali, called Bahá'u'lláh (1817-92), under whom the gospel of equality, service, and spiritual unity of mankind spread in the East. Under Bahá'u'lláh's son, 'Abdu'l-Bahá (1844-1921), movement was carried to Europe, U. S., and Canada; about 2500 members in U. S. The great Bahai temple at Wilmette, Ill., was begun 1921 and dedicated 1931.

Bahamas (*bā-hā-máz* or *bā-hū-máz*), group of islands, British West Indies; 4400 sq. mi.; pop. 60,000: B-15, W-72, *maps* W-72b, U-188c boats, Nassau, *picture* W-72d

Bahia (*bā-ē-ā*), state of Brazil on central seacoast; 204,393 sq. mi.; pop. about 4,000,000; cap. São Salvador (formerly called Bahia); cacao, tobacco, sugar, coffee, hides: *map* S-208b

black diamonds B-226a

Bahia, city in Brazil. *See in Index* São Salvador

Bah'ia Blanca, Argentina, seaport and railroad center; pop. 110,000; exports wheat, wool; government naval station: A-280b, *maps* A-279, S-208c

Bahr (*bār*), Hermann (1863-1934), Austrian critic, novelist, and dramatist; leader of liberal literary movement of the 90's; versatile and brilliant; many plays ('The Concert'; 'The Apostle'; 'The Master') and novels; autobiography.

Bahrein (*bā-rān*) Islands, British protectorate in Persian Gulf; pop. 120,000; chief island, Bahrein, 27 mi. long and 10 mi. wide; its town Manama is cap. of protectorate; important oil-producing region: A-238, *map* A-242

pearl fisheries and oil P-134

Baht, or bat, the monetary unit of Siam, nominally worth about 45 cents; formerly called tical.

Bahutu, a short, dark people of the Belgian Congo, ruled by the Batussi.

Balkal (*bā'kāl*), lake in s. Siberia B-15, *maps* A-332a, b inhabitants of region M-224

Bail, legal term for the security given by one person so that another, under arrest, may enjoy his freedom until the date of his trial.

Bail, in cricket C-395

Baile Atha Cliath (*būw'la ā'hā klē'ā*), native name of Dublin, cap. of Ireland (Eire); pop. 468,000: D-115, *maps* E-270a, E-279, *picture* I-127

Bailey, Hackaliah, American showman C-237b

Bailey, Liberty Hyde (born 1858), American botanist and horticulturist, born South Haven, Mich.; professor horticulture 1888-1903, dean of College of Agriculture 1903-13, Cornell University; made important investigations in horticulture, rural economics, and education; editor, standard encyclopedias of horticulture and agriculture; poet ('Wind and Weather'); author of many books on gardening ('The Garden of Larkspurs').

Bailey, Temple (Irene), American novelist, born Petersburg, Va.; novels are romantic and appeal particularly to youth ('The Tin Soldier'; 'The Dim Lantern'; 'Wallflowers'; 'Silver Slippers'; 'Wild Wind').

Bailey wall, of medieval castle C-92, *picture* C-93

Bailiff, an officer of court whose chief duties are generally to preserve order and to take charge of prisoners under arraignment; in England the term is applied to a superior servant or agent and also to an officer of the court.

Bail'lie, Joanna (1762-1851), Scottish poet and dramatist ('Plays on the Passions'; 'De Montfort'; many simple songs and poems of much charm).

Bailly (*bā-yē*), Jean Sylvain (1736-93), French savant, born Paris; wrote important treatises on astronomy; executed by revolutionists.

Bailment, in law, an agreement by which the bailor transfers to the bailee the possession of, but not the title to, tangible personal property for the accomplishment of a specific purpose, on the understanding that, when the purpose has been accomplished, the identical personal property will be returned to the bailor.

Bail out, in aviation, slang expression, meaning to jump from an aircraft with a parachute.

Bain, Alexander (1818-1903), Scottish philosopher and educator; raised standard of education in Scotland, and greatly influenced teaching of grammar and composition; first British educator to stress necessity of separating psychology from metaphysics; made a study of physical origin of feeling and emotion.

Bainbridge, William (1774-1833), American naval officer, born Princeton, N. J.; in war with Tripoli commanded the *Philadelphia*, captured a Moorish frigate, but was himself taken prisoner with more than 300 men; in War of 1812, in command of the *Constitution*, cap-

tured the British *Java* off the coast of Brazil in a terrific combat.

Baird, John L. (born 1889), Scottish inventor of televisior, first practical television apparatus T-41

Baird, Spencer Fullerton (1823-88), American naturalist, born Reading, Pa.; made vast collection of North American vertebrate fauna; secretary of Smithsonian Institution; as head of Commission on Fish and Fisheries, organized science of fish culture; started the marine laboratory at Woods Hole, Mass. deep-sea exploration E-345

Baireuth. See in *Index* Bayreuth

Bairnsfather, Bruce (born 1887), English cartoonist, born Murree, India; served in World War of 1914-18; famous for war cartoons of 'Old Bill'; successful play 'The Better 'Ole' based on adventures of 'Old Bill'; founded *Fragments*, a weekly comic paper.

Baiting, in falconry F-7

Baize (*bāz*), a loosely woven, napped woolen or cotton fabric, finished to imitate felt; used for table covers, linings for jewelry and instrument cases, etc.

Baja California (*bā'hā kā-lē-fōr-nē-ā*). See in *Index* California, Lower

Bajaus (*bā-jous'*), a native tribe of British North Borneo; principal settlements along Tampasuk River; Bajau a synonym for pirate.

Bajazet (*bā-jū-zēt'*), or **Bayazid** (*bā-yā-zēd'*) I (1347-1403), first Ottoman sultan, victor over allied Christian armies at Nicopolis (1396) defeated by Mongols M-224

Bake'lite, a synthetic plastic material P-245i-j, C-289 electric insulating properties E-221, 222

Baker, Bryant (Percy) (born 1881), American sculptor, born London, England; works include 'The Pioneer Woman', at Ponca City, Okla.; 'Pioneer Mother', Topeka, Kan.; statues of Woodrow Wilson and King Edward VII of England; many portrait busts.

Baker, George F. (1840-1931), American banker and philanthropist, born Troy, N. Y.; many years president First National Bank, New York City; director U. S. Steel Corporation and many other companies; from small clerkship in state banking department rose to dominant position in American finance; gave millions for educational and benevolent purposes.

Baker, George Pierce (1866-1935), American professor, born Providence, R. I.; professor of English and director of "The 47 Workshop" at Harvard 1905-24; professor of drama and director of University Theater at Yale, 1925-33; leader in revival of American drama.

Baker, Newton Diehl (1871-1937), American lawyer and Democratic leader, born Martinsburg, W. Va.; city solicitor of Cleveland 1902-12; mayor of Cleveland 1912-16; U. S. secretary of war under President Wilson 1916-21; member Court of International Justice 1928; member Law Enforcement (Wickersham) Commission: picture W-170

Baker, Ray Stannard (born 1870), American writer, born Lansing, Mich.; director American Press Bu-

reau at Paris Peace Conference; contributed articles on industrial and political problems to newspapers and magazines; wrote 'Adventures in Contentment' and other idyllic rural studies under pseudonym "David Grayson"; 'Woodrow Wilson—Life and Letters', monumental biography.

Baker, Remember (1740-75), leader of Green Mountain Boys V-288

Baker, Sir Samuel White (1821-93), English explorer, discoverer of Lake Albert.

Baker, Mount, volcanic peak of Cascade Range in n.w. Wash.; 10,750 ft.: map W-29

Bakeries B-229-32 automatic devices A-384

Baker Island, a tiny sand and coral island in mid-Pacific, colonized by the United States in 1935 for use as a way-station for planes flying from the Hawaiian Islands to Australia: map P-10c

Bakersfield, Calif., trading and manufacturing city 100 mi. n. of Los Angeles in oil and farming region; pop. 29,252; oil refineries; packed fruits, agriculture and oil tools: map C-28

Baker University, at Baldwin, Kan.; Methodist; founded 1858; liberal arts, fine arts.

Bakewell, Robert (1725-95), established scientific stock breeding C-103

Bakhtiari (*bāk-tē-ā-rē*), a nomadic people, native to Persia, pictures A-327, M-167

Baking C-349 bread B-229-31 cakes and crackers B-232

Baking powder B-15 alum in B-15 ammonium bicarbonate A-188 chemical properties, picture A-10 gluten holds gas F-118 in self-rising flour B-229

Baking soda, sodium bicarbonate S-189 in baking powder B-15 Solvay process produces S-190

Bakst (*bākst*), **Leon Nikolajewitsch** (1868-1924), Russian genre and portrait painter and decorative designer; best known as designer of stage settings and costumes, especially for Diaghileff's Russian ballet: T-77

Baku (*bā-ke'*), Russia, oil center and seaport, cap. of Azerbaijan, Soviet Socialist Republic, on w. coast of Caspian Sea; pop. 810,000: C-92, map E-326e

petroleum P-145-6

railroad connections C-116

sacred fire from natural gas G-23

Bakunin (*bā-kgū'nin*), **Michael** (1814-76), Russian anarchist and a founder of Nihilism; exiled to Siberia for life; escaped to Europe; founded Social Democratic Alliance which soon merged with the International; views so anarchistic he was expelled from International and went to Switzerland, where he died.

Balaam (*bā'lām*), prophet disobedient to divine command until miraculously rebuked by his ass; compelled against his will (Num. xx-xxiv) to bless Israel.

Balakiref (*bā-lū-kē-rēf*), **Milli Alexeyevitch** (1837-1910), Russian composer; a follower of Glinka, he became the leader of the Young Russian School of music with "truth

and nationalism" as its battle cry; overtures, incidental music to 'King Lear', a piano fantasy 'Islamey', and many songs.

Balaklava (*bā-lā-klāv'ā*), small port of the Crimea, 6 mi. from Sebastopol; scene of famous "charge of the Light Brigade" in battle of Oct. 25, 1854, during Crimean War.

Balalaika (*bāl-ā-lī'kā*), Russian stringed musical instrument similar to a guitar; usually consists of triangular body with long neck.

Balance, or **Libra**, sign of zodiac Z-218

Balance, for weighing W-65

Balance, of the body, how maintained E-127-8

Balanced diet F-146

Balance of nature B-144-5. See also in *Index* Ecology; Struggle for existence

Balance of payments I-110c, table I-110b

Balance of power, condition among nations in which none has sufficient power to endanger the independence of the others Europe E-324

Balance of trade I-110c American Colonies and England A-158-60

favorable balance, meaning I-110c

foreign exchange F-153

imports and exports of U. S. compared U-196, I-110b, pictograph U-197

mercantile theory C-322-3, I-110c, A-159

Balance wheel, of watch W-37, '39, picture A-386 resembles torsion pendulum P-109

Balanchine (*bāl'ān-shēn*), **George** (born 1904), ballet dancer and choreographer, born St. Petersburg (Leningrad), Russia; ballet master of Diaghileff's Russian Ballet 1924-28 for which he composed 'The Nightingale', 'Prodigal Son', 'Gods Go a Begging', and other ballets; came to U. S. 1933; produced ballets for Metropolitan Opera Assn., The American Ballet, and for musical comedies.

Balard (*bā-lār'*), **Antoine Jerome** (1802-76), French chemist, discoverer of bromine.

Bal'as ruby, a rose-red to pink spinel, used as a gem.

Balata (*bāl'ā-tā*), a rubber gum obtained from the bark of the evergreen bullet tree (*Mimusops balata*), native to West Indies and S. America; used as substitute for gutta-percha, and in cables, golf balls, machine belting.

Balaton, Lake. See in *Index* Platten See

Balbo, Italo (1896-1940), Italian air marshal, governor of Libya; made head of Italian armed forces in North Africa 1937; killed in airplane crash in Libya transatlantic flight, table A-74

Balboa (*bāl-bō'ā*), **Vasco Nuñez de** (1475-1517), Spanish explorer, discovered Pacific B-15, picture P-1 accompanied by Pizarro P-228

Balboa, Pacific port of Panama Canal Zone, 3 mi. e. of city of Panama; pop. 3922: P-53, map P-52

Balboa, the monetary unit of Panama, worth about \$1.00 in U. S. money; generally disregarded in favor of American money.

Balbriggan, seaport in Ireland about 20 mi. n.e. of Dublin; pop. 2500; balbriggan hosiery and underwear made of fine unbleached cotton

- originated here; England and America now the chief producers; name also given to a jersey cloth with mixed colors.
- Bald cypress** C-420
- Bald eagle** E-123, 125, *pictures* E 123, 124, *color plate* B-135
- Balder** (*bald'ēr*), Norse god B-16
- Balder's brow, flower** B-16
- Baldness, or alopec'ia** H-196
- Baldovinet'ti, Alesso** (1425?-99), Florentine painter and decorative artist; noted for Biblical paintings and portraits; famous mosaist; decorated shields, banners, chests; experimented with oil paints and methods of mixing colors, also with science of perspective.
- Baldpate duck, picture** D-117
- Baldwin I** (1058-1118), adventurer prince of First Crusade; youngest brother of Godfrey of Bouillon; first king of Jerusalem; crowned 1100.
- Baldwin, Abraham** (1754-1807), American statesman, born North Guilford, Conn.; chaplain in Revolutionary army; moved to Georgia 1784; first president of Franklin College; member of Georgia's first House of Representatives; U. S. senator 1799-1807.
- Baldwin, Elias J. ("Lucky")** (1828-1909), discovered famous Ophir gold mine, Nevada; lost his fortune and tried again unsuccessfully in Alaska: N-78
- Baldwin, Frank Dwight** (1842-1923), U. S. Army officer, born Manchester, Mich.; fought in Civil War and in Philippines but best known for his work against the Indians: *picture* S-219
- Baldwin, James** (1841-1925), American author and compiler; born Hamilton County, Ind.; became schoolbook editor; edited mythological and other classical stories for children ('Old Greek Stories'; 'Four Great Americans'; 'The Golden Fleece') Norse tales S-303c
- Baldwin, James Mark** (1861-1934), American psychologist, born Columbia, S. C.; professor of philosophy and psychology, University of Toronto, Princeton, Johns Hopkins, and National University of Mexico; well known in the fields of child, social, and experimental psychology ('Story of the Mind'; 'Mental Development in the Child and the Race'; 'History of Psychology').
- Baldwin, Matthias W.** (1795-1866), American inventor; built first locomotive to draw a train in Pennsylvania; laid foundation for Baldwin Locomotive Works, Philadelphia.
- Baldwin, Robert** (1804-58), Canadian statesman B-16
- Baldwin, Simeon Eben** (1840-1927), American jurist; chief justice Conn. Supreme Court 1907-10; governor of Connecticut 1911-15; member of faculty, Yale Law School 1869-1919; one of founders of American Bar Association.
- Baldwin, William Warren** (1775-1844), Canadian politician, lawyer and physician, born Ireland; member of Legislative Assembly of Upper Canada 1824-30; leader of the Reform party; father of Robert Baldwin.
- Baldwin Locomotive Works, Philadelphia** P-160
- Baldwin of Bewdley, Stanley Baldwin, first Earl** (born 1867), British statesman B-16-17, E-276, 276a
- Baldwin-Wallace College, at Berea, Ohio; Methodist; founded 1845; liberal arts and sciences, religion, music, teacher training, business administration.**
- Bale, John** (1495-1563), British author, bishop of Ossory, Ireland; champion of Reformation; wrote mystery and miracle plays; 'King John', forerunner of English historical drama; and a bibliography of English literature ('Index Britanniae scriptorum').
- Bale** (*bāl*). See in *Index* Basel
- Bale, of cotton** C-376-8, *picture* A-98a
- Balearic** (*bāl-ē-ār'ik*) Isles, Spanish Balears (*bā-lā-ār'ās*), province off Mediterranean coast of Spain; 1935 sq. mi.; pop. 330,000: B-17, map S-226
- Baleen', or whalebone** W-78
- Baleen whales** W-78, E-341
- Balestier** (*bāl-ēs-tēr*), Charles Wolcott (1861-91), American author and publisher born Rochester, N. Y. ('Life of James G. Blaine'; 'A Victorious Defeat') collaborates with Kipling K-24a Kipling's elegy, quoted K-24a, 25
- Balfe** (*bālf*), Michael William (1808-70), Irish composer, born Dublin; studied on the Continent; prolific composer; best known work is light opera 'The Bohemian Girl'.
- Balfour, Arthur James Balfour, first Earl** (1848-1930), British statesman, born Scotland; chief secretary for Ireland, 1887-91; became Conservative leader of House of Commons 1891; prime minister 1902-05; retired in 1911; returned to politics at outbreak of World War and served as first lord of the Admiralty, 1915-16; foreign secretary 1916-19; author of Balfour declaration on Palestine; leading British delegate to the Washington Conference 1921-22; raised to peerage, 1922; the last of Victoria's cabinet, an outstanding British statesman of his time; a scholar and philosophic writer ('Foundations of Belief'; 'Theism and Humanism').
- Balfour declaration, statement on Palestine mandate** P-36
- Bali** (*bā'lē*), mountainous island of Netherlands Indies, just east of Java; about 2160 sq. mi.; pop. 950,000; natives resemble Javanese, but with Hindu strain; skilful craftsmen; traces of ancient Hindu culture; old form of Brahmanism chief religion; exports rice, cocoa, coffee: map A-332c
- animals and Wallace's line** E-142b
- birds** B-124
- people, pictures** E-142f
- temple dancer, picture** A-329
- temple god, picture** E-142f
- Balilla** (*bā-lē'lā*), Italian Fascist military organization of boys under 14; similar to Boy Scouts; named in honor of Italian youth who in 1746 hurled a rock at Austrians who were besieging Genoa.
- Baline, Israel. See in Index** Berlin, Irving
- Baliol. See in Index** Balliol
- Balkan Entente** (*ān'tānt'*) B-20, B-271
- Balkan** (*bōl'kān* or *bāl-kūn'*) Mountains, in the Balkan Peninsula, an extension of the Carpathians; beginning at Iron Gates of Danube, extend s. through Serbia, then turn sharply e. to Black Sea; divide Danube and Maritza watersheds: B-17, maps B-18, E-318a
- Balkan Peninsula, s.e. peninsula of Europe** B-17-21, maps B-18, E-326d-e, f, *Outline* B-20-1. See also in *Index* Balkan States
- bibliography** B-21
- history** B-17-20, *chart* H-303
- Austrian policy before first World War** W-149-50, F-186
- Macedonia** M-5
- 1st World War** W-157, 164, B-20, map W-156; division of Hungary H-362
- 2d World War** B-20
- natural features** B-17
- people** B-17-18; games P-250
- shelter, pictures** B-19
- Balkan States, the countries of the Balkan Peninsula, at present Albania, Bulgaria, Greece, Yugoslavia, Rumania, and European Turkey: Outline** B-20-1. See also in *Index* Crimean War; Russo-Turkish Wars; and individual states by name
- Balkan Wars**
- (1828-29) B-19-20
- (1877-78) T-163-4, B-20: Bosnia and Herzegovina B-198; Disraeli's diplomacy D-71
- (1912-13) B-20
- Bulgaria** B-270-1
- Greece, territorial gains** G-162
- Macedonia** M-5
- Montenegro** M-247
- Rumania** R-174
- Serbia** S-80
- treaty signed at Bucharest** B-20
- Balkh** (*bālk*) (Turkish 'high town'), Afghanistan, chief city of district of Balkh; ancient city (Bactra) early rival of Babylon and Nineveh; center of Zoroastrian religion; pop. 15,000: map A-332b
- Balkh, district of Afghanistan. See in Index** Bactria
- Balkhash** (*bāl-kāsh'*), lake in the Kazakh Soviet Socialist Republic, near Chinese border; w. section contains fresh water from Ili River, e. section is salt; about 6370 sq. mi.; 4th largest lake in Eurasia: map A-332b
- Balk line, in billiards** B-108
- Ball, John** (died 1381), a leader in Wat Tyler's Rebellion T-171
- Ball, Mary, maiden name of George Washington's mother** W-13
- Ball, Thomas** (1819-1911), American sculptor, born Charlestown, Mass.; influenced trend of American sculpture; work shows dignity, sincerity, and accuracy of subject ('Emancipation Group'; equestrian statue of Washington in Boston).
- Ball, William, great-grandfather of George Washington** W-13
- Ball. See in Index** Baseball; Basketball; Billiards; Bowling; Cricket; Field hockey; Football; Golf; Jai-alai; Lacrosse; Ping Pong; Polo; Tennis
- Ballade** (*bā-lād'*), verse form derived from the French, having two variations, the shorter being the more common; consists of three stanzas of 8 or 10 lines each, followed by an envoy of 4 or 5 lines, the last line of each stanza and of the envoy being the same and the rhyme sounds being limited to three or four (*ababbcbc* or *ababbccdc*, in envoy *bcbc* or *ccdc*); example: W. E. Henley's 'Ballade of Dead Actors'.
- Ballads** P-267, 271
- cowboy** F-136
- folk-songs** F-132, 134-6

ü=French u, German ü; gem, *jo*; thin, then; ñ=French nasal (Jean); zh=French j (z in azure); k=German guttural ch

Percy's collection E-286
 Robin Hood R-118, 119
 Scott's interest in S-48-9
Ballarat (*bāl-ā-rāt'*), Australia, city of Victoria, 65 mi. n.w. of Melbourne; pop. 38,000; formerly gold-mining center, now farming and sheep-raising more important in vicinity: *map* A-372a
Bal'last, in balloons B-22; in submarines S-312
Ball bearing F-204
X-ray test, *picture* X-201
Ball clay C-261, P-327
Balleny Islands, group of five, in Antarctic Ocean, about 300 miles s.w. of South Victoria Land; volcanic origin; discovered 1839 by John Balleny, English shipmaster: *map* A-215
Ballet (*bā-lā'*), group performance which interprets music or a story by means of dance movements and pantomime; originated in ancient Rome; became highly developed, and formalized at French court; attained great perfection in Italy; preserved by Russian Imperial Ballet at Moscow where rigid poses were modified by rhythmic dance forms introduced by Isadora Duncan.
Ballet, in music, the music for a dance performed by one or more performers, whose movements are descriptive of an idea or emotion.
Bal'tin, Albert (1857-1918), German shipowner; director-general Hamburg-American Steamship Line, which he developed from insignificance to predominance; practically reorganized German shipping trade.
Ballinger, Richard A. (1858-1922), American lawyer, born Boonesboro, Iowa; secretary of the Interior under Taft: T-2-3
Balliol (*bāl'i-ōl* or *bāl'yōl*), or Balliol, name of a royal English family which emigrated to England with William the Conqueror. Sir John de Balliol (died 1269), married Scottish princess descended from King David I of Scotland and founded Balliol College; his son, John (1249-1315), claimed Scottish throne and, as vassal to Edward I of England, ruled 1292-96; his grandson, Edward, ruled in 1332.
Balliol College, Oxford O-260
Ballista, or catapult M-11, *pictures* F-29
Ballistics (from *ballista*, engine used in ancient times for hurling stones), science treating of impact, path, and velocity of projectiles; interior ballistics treats of motion of projectile in gun; exterior ballistics, of motion after leaving gun.
Bal'listite, an explosive E-348
Ball lightning L-135
Ball mill
 cement-making type C-125-6, *pictures* C-127
Balloon B-21-31. *See also in Index*
 Airship
 aluminum paint, why used A-138
 Andrée's wrecked balloon found, B-22, *pictures* P-286
 "blimp" B-24
 captive B-22, 24, *picture* B-27
 early types B-21-2, *pictures* B-23, 25
 first ascent by man B-21-2, *picture* B-23
 gas B-22, 24; helium H-271, B-26; hydrogen H-368, B-22, 26
 highest ascents A-62, B-22, *pictures* A-63, B-30

kite, or sausage, balloon B-24, 31, *pictures* B-25, 27
 military use B-22-3, 24, *pictures* B-25: barrage against air attack B-31, *picture* B-27
 observation B-22, 24
 parachute P-62
 racing, *picture* B-26
 round balloon, longest trip in B-22
 scientific use B-22, *pictures* A-63, B-30: meteorology W-61-2, B-22, *pictures* A-63, B-24
 sounding balloon B-22, *pictures* B-24
 spider balloonists S-256
Balloon'et, small inflated bag kept within a spherical or dirigible balloon for purpose of retaining shape after loss of gas.
Balloon-flower (*Platycodon grandiflorum*), an herbaceous garden perennial of the bluebell family, with large terminal bell-shaped white, blue, or purple flowers, which in the bud resemble balloons
 how to plant G-11
Ballooning spiders, or aeronautic spiders S-256
Balloon vine, an annual herbaceous garden climber (*Cardiospermum halicacabum*) of the soapberry family, with small white flowers, deeply toothed leaves, and balloon-like seed pods.
Ballot B-31-2
 ancient Athens A-282-3
 short ballot reform B-32, C-382
Ball's Bluff, Va., a bluff on Potomac River about 33 mi. above Washington; Confederate force under General Evans defeated Union force and killed its commander, Col. Edward D. Baker, Oct. 21, 1861.
Balm, or Melissa, a perennial garden herb or shrubby plant (*Melissa officinalis*) of the mint family, rather hairy and loosely branched, with lemon-scented leaves and clusters of yellowish white-flowers; used for culinary flavoring, in perfumery, and in medicine.
Balmaceda (*bāl-mā-sā'dā*), José Manuel (1838-91), elected president of Chile 1886; instituted reforms and extensive public works; made self virtual dictator: C-208
Balm of Gilead, an aromatic resin obtained from a small oriental evergreen tree of myrrh family; alluded to by ancient writers as a precious ointment with high curative value.
Balm of Gilead poplar, a balsam poplar P-304
Balmoral Castle, residence of Queen Victoria in Highlands of Scotland, *picture* S-45
Balmung, in Teutonic mythology, the powerful magic sword of Siegfried; called "Gram" in Norse mythology, and "Nothung" in Wagner's opera "Siegfried"
 Siegfried legend S-140-1, N-140
Balop'ticon S-286
Balor of the Evil Eye, god in Irish legend I-132
Balsa, a boat made of reeds, used on Lake Titicaca, *picture* B-168
Balsa, a raft used in South America, made of light wood or hides, *picture* B-162
Balsa, a tropical tree, found chiefly in Ecuador; wood is the lightest known, about half as heavy as cork, but strong and elastic; composed of minute cells in which air is confined; first used extensively

in first World War; now employed in life rafts, life preservers, airplanes, and dirigibles, and as soundproof and insulating material used for model airplane A-92
Balsam, mixture of volatile oils and resins exuded by trees G-188
 Canada balsam G-188, F-44
 perfumes P-124, G-188
Balsam, garden, a succulent garden annual (*Impatiens balsamina*) of the touch-me-not family with low leafy stem and showy single or double irregular white, rose, red, or yellow flowers clustered in the axils of the leaves on short stalks; close relative of the wild jewelweed.
Balsam apple, a tendril-climbing plant of the genus *Momordica* of gourd family; leaves, heart-shaped, lobed; flower, solitary, small, yellow or white; fruits, orange or sulphur-yellow, oval, sometimes rough. Native to Africa and Asia. Balsam pear in same genus is similar, has coarser foliage; fruit used as food; rind used in medicine.
Balsam Coast, El Salvador S-18
Balsam family, or Balsaminaceae (*bāl-sā-mī-nā'sē-ē*), a family of plants including the jewel-weeds or touch-me-nots and garden balsam.
Balsam fir F-44
Balsamo (*bāl'sū-mō*), Joseph. *See in Index* Cagliostro
Balsam of Peru, or Peruvian balsam, a product of the tree *Myroxylon pereirae* of the bean family; used in medicine, in perfumery, and sometimes as substitute for vanilla; obtained from El Salvador: S-18
Balsam of Tolú, a balsam obtained from a tree of the genus *Myroxylon* found in Colombia, particularly in region of town Tolú, also in Venezuela and Peru; similar to balsam of Peru; used in medicine and perfumery.
Balsam poplar P-304
Bal'sas River, in s. Mexico, flows 500 mi. w. to Pacific M-135, *map* M-133
Balthazar (*bāl-thā'zēr*), one of the Wise Men of the East. *See in Index* Magi
Balt'ic, battle of the, or battle of Copenhagen B-32, N-63
Baltic Provinces, collective name of former Russian provinces of Courland, Livonia, Esthonia; later comprised in Soviet Socialist Republics of Esthonia, Latvia, and Lithuania. *See also in Index* Baltic States
Baltic Sea B-32, *map* E-326d-e. *See also in Index* Ocean, table
 canals C-68, V-334
 chief source of amber A-140
 fisheries E-318
 Russia gets foothold P-143
 Sweden's possessions S-340
Baltic States R-194b, *map* E-326e, Outline R-195
 bibliography R-196
 dictatorships, reasons for D-67d
 Esthonia E-306
 Finland F-44
 Latvia L-71
 Lithuania L-164
Baltic-White Sea Canal C-68, table C-433
Bal'timore, Cecilius Calvert, 2d Baron (1605?-75), founds Maryland M-78, *picture* A-152
 grants religious freedom C-233, M-78
Baltimore, George Calvert, first Baron (1580?-1632), founder of Avalon colony in Newfoundland (1621);

Key—cāpe, át, fär, fást, whät, fgll; mē, yēt, fērn, thäre; ice, büt; rōw, wón, fōr, nōt, dā; cūre, büt, ryde, füll, búrn:

applied for charter for Maryland, which was granted after his death to his son Cecilius.

Baltimore, chief city of Maryland; pop. 859,100: B-33, M-77, *map* M-78 Enoch Pratt Library, *picture* L-106c fire (1904) B-34

first gas street lights G-22

first telegraph line T-30

Peabody Institute P-91

War of 1812 B-34, W-10

Baltimore & Ohio Railroad M-77, R-37

Baltimore clippers S-118, M-77

Baltimore oriole O-251, *picture* O-250 nest, *pictures* O-250, B-127

Baluchis (*bā-lū'chēz*), members of the dominant race of Turko-Iranians of Baluchistan from whom that country took its name.

Baluchistan (*bā-lū-chī-stān'*), a rugged, sparsely populated country on Arabian Sea in extreme w. corner of Indian Empire; rich in minerals; poor agricultural areas; extreme climate; 134,638 sq. mi.; pop. 870,000; partly (British Baluchistan) under British rule: *maps* I-30, 31

Baltichtherium, prehistoric monster E-344

Balzac (*bāl-zāk'*), Honoré de (1799-1850), French novelist B-35, F-197 influence on the novel N-183

Bamako (*bā-mā-kō'*), capital of French Sudan, in western Africa on the navigable Niger River; connected by rail with Dakar; pop. 20,000: *map* A-42a

Bambala, a Bantu-speaking people of dark brown color in the Congo region, central Africa.

Bumberg (*bām'bérk*), Germany, Bavarian city 33 mi. n. of Nuremberg; pop. 50,000; 11th-century cathedral; large breweries, cotton and woolen mills.

Bamboo, a treelike grass B-35-6, G-136j producing regions B-35: China C-221b; Japan J-187; Philippines P-169

uses B-36: filaments in electric light bulbs B-234; houses, *pictures* P-166, C-307; source of cellulose, *chart* C-123

Bambuco (*bām-by'kō*), a dance L-67k

Bamian (*bā-mī-ān'*), valley and pass in Afghanistan 60 mi. n. w. of Kabul; colossal Buddhist idols carved in rock; other historic remains; city destroyed (1222) by Genghis Khan.

Ban (*bán*), plural **bani** (*bā'nī*), Rumanian coin; 100 equal one leu.

Ban'ak, or Bannock, Shoshonean Indian tribe of n.w. plateau region of U.S.; formerly roamed through s. Idaho: I-54

Banana B-36-8

flour B-37

food value B-37-8

growing and shipping B-37-8

picked when green B-36

plant, uses B-37

producing regions B-36: Central America C-133b, G-181c; Jamaica B-38, *picture* J-182; Panama P-41, *picture* P-42

varieties B-36, 38

Banana oil, popular name for amyl acetate, a colorless liquid of fruity odor; very useful as an organic solvent; used in lacquers and artificial fruit essences: C-180

Banat of Temesvar (*bā'nūt* of *tēm'esh-vār*), fertile district lying between Danube and Theiss rivers and Transylvanian Alps; 11,000 sq. mi.; formerly part of Hungary, later divided between Rumania and Yugoslavia. "Banat" means province or district; Temesvar, Rumanian Timisoara, is principal city.

Ban'bury, England, market town in Oxfordshire, 65 mi. n.w. London; center of zealous Puritans in 17th century who destroyed ancient cross celebrated in nursery rhyme, "Ride a cock horse to Banbury Cross"; pop. 13,000.

Banco del Giro, Venice B-43

Banco di Rialto, Venice B-43

Ban'croft, George (1800-91), American historian and statesman, born Worcester, Mass.; as secretary of navy to President Polk, planned Naval Academy at Annapolis ('History of the United States'): A-179 estimate of Polk P-297

Bancroft, Hubert Howe (1832-1918), American historian, born Granville, Ohio; important histories of Western states ('West American Historical Series').

Bancroft, Richard (1544-1610), archbishop of Canterbury; zealous and bitter foe of Puritans; became bishop of London 1597, archbishop of Canterbury 1604; "chief overseer" authorized version of Bible.

Band (music)

boys' harmonica bands H-224-5 distinguished from orchestra O-240

Ban'da, group of tribes in French Equatorial Africa n. of Ubangi River; use lip disks.

Banda Islands, Netherlands Indies, part of Molucca Archipelago, in Banda Sea, 50 mi. s. of Ceram; 20 sq. mi.; pop. 10,000

nutmegs and mace N-187

Bandar, India. *See in Index* Masulipatam

Bandar (*bān'dār*), or Rhesus monkey M-230, M-231, Z-221, *picture* M-226

Bandar Ab'bas, Persia, seaport on Strait of Ormuz, Persian Gulf; pop. 10,000; exports fruit, tobacco, wool, carpets, opium: *map* A-332c

Bandar Shah, Persia, strategic port on Caspian Sea; northern terminus of Trans-Iranian Railroad; P-132

Bandar Shahpur, Persia, strategic port on Persian Gulf; southern terminus of Trans-Iranian Railroad: P-132

Banda Sea, part of Pacific Ocean, in East Indies, s. of Moluccas; greatest depth about 24,000 ft.; *maps* E-142a, P-10b

Banded ant-eater, an Australian marsupial K-2

Banded dragon-fly D-90

Banded rattlesnake R-52

Bandelier (*bān-dē-lēr*), Adolph F. A. (1840-1914), American archeologist and historian, born Switzerland; leading authority on archeology of s.w. U. S., Mexico, Peru, and Bolivia ('Final Report of Investigations among the Indians of the Southwestern United States').

Bandelier National Monument, New Mexico N-20

Ban'dicoot, small, burrowing animal of the marsupial genus *Perameles*; found in Australasia; feeds on worms, insects, vegetables, and grain: K-2

Bandoeng (*bān'dong*), Java, inland city; pop. 165,000: J-205, *map* A-332c

Band saw F-222, L-218, *pictures* F-220, L-216

Bandurria (*bān-dq'ri-ā*), a Spanish wire-stringed musical instrument.

Bandy, Welsh name for hockey H-314

Banff (*bām/f*), Alberta, health and pleasure resort in Bow River valley in Canadian Rockies; pop. 2037; altitude 4500 ft.; annual winter sports carnival: *map* C-50b

Banff National Park, Alberta, formerly Rocky Mountains Park N-22f, A-111, *map* C-50b, *picture* C-48

Bangalore (*bāng-gā-lōr'*), chief city and British administrative cap. of native state of Mysore, in s. India; pop. 305,000; British military station; tobacco, textiles: *map* I-30

Bangkok, cap. of Thailand, near mouth of Menam River; pop. 885,000: B-38, *map* A-332c

Vat Arun, or **Vat Chang**, *pictures* T-73b, A-275

Bangkok hats C-275

Ban'gor, Me., on Penobscot River 60 mi. from sea; pop. 29,822; paper, footwear, packing-house and foundry products; Bangor Theological Seminary: M-38, *map* M-38

Bangor, old cathedral city on coast of Wales; pop. 11,000; seat of bishopric since 6th century; University College of North Wales; slate quarries.

Bangs, John Kendrick (1862-1922), American humorist, born Yonkers, N. Y. ('A Houseboat on the Styx'; 'Mr. Bonaparte of Corsica'; 'The Foothills of Parnassus'; 'The Idiot').

Bangui (*bāng'gē*), capital of Ubangi-Shari in French Equatorial Africa, on Ubangi River at n.w. border of Belgian Congo; pop. 2000: *map* A-42a

Bangweulu (*bāng-wē-q'q*), or **Bangweolo**, Lake, in Northern Rhodesia, 150 mi. long; formed by headstreams of Congo: *maps* A-42a, C-331

discovered by Livingstone L-169

Banian, or **banyan**, tree B-45

Banjermasin, Dutch Bandjermasin (*bān-jēr-mā'sin*), seaport, chief town in Dutch Borneo, built mainly on piles; cap. of South and East Borneo residency; pop. 66,000; exports spices, gold: B-197, *map* E-142

Ban'jo, a stringed instrument B-38

Bank, financial institution. *See in Index* Banks and banking

Bank acceptance C-393

Bank for International Settlements I-110

Bankhead-Jones Act (1935) E-182

Bankhead-Jones Farm Tenant Act (1937) A-57

Bank holidays, in England H-323

Bankimachandra Chattopadhyaya (Bankim Chandra Chatterji) (1838-94), Indian novelist of Bengal I-42

Banking, airplane A-75-6, *diagram* A-75

indicator A-76

Banking acts. *See in Index* Banks and banking *subhead* laws

Banknote, a form of paper money B-43, M-220b, 221. *See also in Index* Paper money

Federal Reserve issue F-22

how made M-222

Bank of Amsterdam B-43

Bank of England B-43, L-185-6

Bank of France B-43

Bank of Genoa G-30

Bank of North America M-261, B-43

Bank of Sweden B-43

Bank of the United States first and second banks chartered B-44

Jackson vetoes charter J-178-9
Tyler opposes reestablishment T-171
Bankruptcy, legal admission by a debtor that he is unable to pay his debts in full B-38-9
Banks, Sir Joseph (1743-1820), English naturalist; accompanied Captain Cook 1768-71; first man to study marsupials of Australia; discovered geysers in Iceland.
Banks, Nathaniel Prentiss (1816-94), American soldier and politician, born Waltham, Mass.; speaker U. S. House of Representatives 1856; governor of Massachusetts 1858-61; Federal general in Civil War; in House of Representatives 1864-77.
Banks and banking B-39-45. *See also in Index* Money acceptance C-393 banknotes M-220b, 221: origin B-43 branches B-44 building and loan associations B-262 capital, surplus, and undivided profits B-39, 40-1 central England B-43, L-185-6 France B-43 Genoa G-30 Sweden B-43 United States: Bank of North America M-261, B-43; Bank of the U. S. B-44, J-178-9, T-171; Federal Reserve system F-21-2 chain banking B-44 checking accounts B-40: Venice in 1587 B-43 clearing house operations B-42 closing, temporary, 1933 crisis B-44 commercial E-150 coöperative banks B-45 correspondent banks B-42 credit C-392-4: Federal Reserve functions F-21-2 credit union B-45 deposits: demand and time B-39-40, 43; Federal Deposit Insurance Corporation B-43; interest, figuring P-121-2 discount P-121-2, C-393: rediscount system F-21-2 examination and supervision B-42, 44, U-223 failures B-39, 43, 44 farm credit (U. S.) F-12 Federal Reserve system F-21-2 foreign exchange F-153 frozen assets B-43 insurance of deposits B-43 interest and discount P-120-2 international I-110d: Bank for International Settlements I-110 investment banking E-150, B-42: Securities Act, 1933 R-146f investment trusts T-147 labor banks B-45 laws: ancient B-43; U. S. national and state laws B-44; acts of 1933 B-42, 43, R-146f; Federal Reserve system F-21-2 letter of credit C-393-4 liabilities to depositors B-39-40; to stockholders B-40-1 liquid assets B-39 loans B-39, 41, F-12 London's banking district L-185-6 Middle Ages L-181 national B-42, 44 Federal Reserve membership F-21-2 first in U. S. established by Hamilton H-205, B-44 supervision U-223 negotiable instruments C-393 New York financial center N-133 open market operations F-22 origin of term B-43 overdrafts B-40 political party platforms P-292 postal savings bank P-318-20 private banks B-42

protection: armored bank truck, picture A-405 Renaissance period R-76-7 reserves F-21-2, B-41 "run" on B-39 safety deposit vaults, B-42-3, picture B-41 savings banks, or departments B-40 school banks T-87 small-loan departments, or institutions B-44-5 state banks B-42, 44 trust and savings bank T-147-8 trust companies T-147-8 trust department B-43 vocation V-327
Bankside, theater district of London S-95, picture S-99
Banks Island, Canadian island in Arctic Ocean; discovered by Parry 1819; named for Sir Joseph Banks: map C-50b
Banks of Newfoundland. *See in Index* Newfoundland Banks
Bank swallow, rough winged swallow, or sand martin S-332
Banneker, Benjamin (1731-1806), Negro astronomer, naturalist, author; born near Baltimore of freed Negro parents; published accurate almanacs; built first striking clock in America; discovered 17-year cycle of locust plagues.
Ban'nock, or **Ban'ak**, Shoshonean Indian tribe of n.w. plateau region of U. S.; formerly roamed through s. Idaho: I-54
Bannock, a kind of unleavened bread, usually made with barley or oatmeal and cooked on a griddle; common in early New England and the American frontier generally in Scotland B-228
Bannockburn, village in Scotland 2½ mi. s.e. of Stirling, on the Bannock, an affluent of the Forth battle of B-252, H-322
Banquo (*bāng'kō* or *bāng'kwō*), Scottishthane in Shakespeare's 'Macbeth' murdered by Macbeth; his ghost appears at a royal feast.
Ban'shee, in Celtic folk-lore a supernatural being who foretells the death of a member of a household by mournful screaming at night.
Bantam (*bān-tām'*), seaport of Java, formerly important; 60 mi. w. of Batavia; gave name to bantam fowls.
Bantam fowls P-339
Banteng (*bān'tēng*), or **banting**, small wild ox of East Indies (*Bos sondaicus*) C-102 importation into U. S. forbidden Z-223
Banting, Sir Frederick Grant (1891-1941), Canadian scientist, born Alliston, Ontario; co-discoverer of insulin; Nobel prize in medicine 1923: G-100
Bantock, Sir Granville (born 1868), English composer; colorful orchestration; evolved new choral technique ('Atalanta in Calydon'; 'Vanity of Vanities'; 'Burden of Babylon').
Bantry Bay, Ireland, map E-270a
Ban'tu, group of tribes in central, east, and south Africa, including Kafirs, Zulus, Bechuanas, Basutos A-39, T-8, M-294 huts, picture A-40
Banya-Bashi mosque, Sofia, picture B-270
Ban'yan tree B-45
Baobab (*bā'ō-bāb*), or monkey-bread tree T-131

Bapt, John (1815-87), Jesuit missionary, born La Roche, Switzerland; ministered to Abnaki Indians and white settlements in Maine (1848-54) until exiled by "Know-Nothing" party; rector of Boston College 1859-69.
Baptisia (*bāp-tiz'ī-ā*), or **false indigo**, a genus of perennial plants of the pea family; leaves, divided into 3 leaflets; flowers yellow, blue or white, in clusters; native to North America.
Baptism, a ceremony by which one becomes a member of a Christian church
Anabaptist view P-369 church sacrament C-232 of Jesus J-214
Baptistery, the portion of a church or the separate building set aside for baptisms
Florence I-168, picture F-108: Ghiberti's doors G-84, I-168, picture G-85 Pisa P-222, picture I-168
Baptists, Protestant denomination which maintains that baptism should be administered to believers only and should be by immersion only; membership in U. S. about 8,300,000 beginnings in England P-369 United States C-233, W-104
Baptist Young People's Union of America, an organization formed in 1891 by the federation of Baptist young people's societies in U. S. and Canada; object is the unification and religious development of Baptist young people.
Bar, in physics, pressure exerted by a force of 1,000,000 dynes on a square centimeter of surface; equivalent to pressure exerted by a column of mercury 29.53 in. high. *See also in Index* Dyne
Bar, wrestling term W-183
Barabas (*bār-āb'ās*), Marlowe's 'Jew of Malta', an avaricious, murderous monster; type humanized by Shakespeare into Shylock.
Barab'bas, a robber released by Pilate on demand of Jews when Jesus was condemned.
Bar'aboo, Wis., city on Baraboo River 32 mi. n.w. of Madison; pop. 6415; woolen products, playground equipment
Ringling circus C-237c
Barada (*bā-rā'dā*), small river of Syria flowing through Damascus; supposedly the Abana of the Bible agricultural products D-8
Baranof (*bā-rān'ōf*) Island, one of chief islands of Alexander Archipelago, Alaska; 100 mi. long; town of Sitka on w. coast: map N-150b
Barany (*bā-rā-nē'*), Robert (1876-1936), Austrian physician; Nobel prize in medicine (1914) for improvements in methods of diagnosis; after 1916 professor at University of Uppsala.
Barat (*bā-rā'*), Madeleine Sophie, Saint (1779-1865), founder of the Society of the Sacred Heart, born Joigny, Burgundy, France; the Society, founded in 1800, received papal approbation in 1827. Canonized 1925; feast day, May 25.
Barataria (*bā-rā-tā-rē-ā*) Bay, La., on Gulf of Mexico, w. side of Mississippi delta; headquarters in early 19th century of famous band of pirates.
Baratta (*bā-rāt'tā*), Francesco (died 1666), Italian sculptor, pupil and follower of Bernini; best work

Key—cāpe, āt, fār, fāst, whāf, fāll; mē, yēt, fērn, thēre; īce, bīt; rōw, wōn, fōr, nōt, dō; cūre, būl, rŭde, fŭll, būrn;

- fountain in Piazza Navona, Rome; also did the high altar in church of San Niccolò di Tolentino in Rome; several of his statues on Greek subjects bought by Augustus II for Dresden Gardens.
- Barb**, a breed of light horses introduced by the Moors into Spain from Barbary; noted for speed and endurance: H-343
- Barb**, pigeon P-216
- Barbados** (*bär-bä'dōz*), island of British West Indies; pop. 200,000; 166 sq. mi.: B-45, map N-150c natives, picture W-72d
- Barbara**, Saint, virgin martyred about 285 A.D. by order of her father, a heathen, who was struck by lightning as punishment; protectress in thunderstorms and patroness of artillerymen and miners; feast day December 4.
- Barbara Frietchie**. See in Index Frietchie, Barbara
- Barbarians** (from Greek word meaning stammering, foreign), name given by Greeks to all people who did not speak Greek, primarily to express the strangeness of the foreign languages; later used by Romans to designate all people except Greeks and Romans; finally came to mean uncivilized, brutal, or crude persons.
- Barbarism**, a state of society between savagery and civilization C-244 invention of pottery M-48
- Barbarossa** (*bär-bä-rōs'ä*) ("red beard"), nickname for Frederick I (1123?-90), Holy Roman emperor F-190
- Barbarossa**, Khair ed Din, Turkish pirate, who terrorized Mediterranean in 16th century T-151
- Barbary sheep**, or aoudad S-104
- Barbary States**, region of n. Africa, named from Berbers, original inhabitants; includes Morocco, Algeria, Tunisia, Libya: map A-127 Moors in M-255
- pirates P-222: Cervantes captured by C-135; Decatur's expedition D-23; United States Navy and N-56e
- Barbauld** (*bär'bäld*), Anna Letitia (1743-1825), English author; now chiefly remembered for religious poems, simple in feeling and style ('Hymns in Prose'; 'Evenings at Home', with her brother, Dr. John Aikin; 'Ode to Life').
- Barbecue**, outdoor feast where animals are roasted whole, formerly common in s. and w. U. S.; term applied also to the process of such roasting; custom of the feasts largely disappearing, but traces of it seen in the method of cooking meat in "barbecue" refreshment stands along highways.
- Barbed wire** W-121 use in warfare W-121, W-156
- Barbel**, soft, slender "feeler" around mouth of certain fishes, such as catfish, cod, drumfish, goatfish, sturgeon: F-70
- Barbellon** (*bär-bē'lyōn*), W. N. P., pen name of Bruce Frederick Cummings (1889-1919), English diarist and scientist ('Journal of a Disappointed Man'; 'Enjoying Life and Other Literary Remains of W. N. P. Barbellon'; 'A Last Diary').
- Barber**, John, inventor of a gas engine G-20
- Barber**, Samuel (born 1910), composer, born West Chester, Pa.; began to compose at age of 7; won Pulitzer prize in music 1935, 1936 ('Dover Beach'; 'Music for a Scene from Shelley').
- Barber** (from Latin *barba*, beard), one who cuts or dresses hair, trims and shaves beards
- medieval barber-surgeons A-191
- Barberini** (*bär-bä-rē'nē*), powerful Italian family in 16th and 17th centuries; Maffeo (Pope Urban VIII) most famous member; great palace in Rome symbol of their wealth; allied by marriage to Colonna family.
- 'Barber of Seville, The'**, opera by Rossini story O-229
- Barberry**, an ornamental shrub H-270 harbors wheat rust R-199, 201, picture R-200
- Barberry family**, or **Berberidaceae** (*bär-bēr-i-dēs'ē-ē*), a family of plants and shrubs, native to Europe, Asia, and the Americas, including the common barberry, mahonia, and may-apple.
- Barber's pole**, origin A-191
- Barberton**, Ohio, manufacturing city 7 mi. s. of Akron on Ohio Canal; pop. 24,028; matches, match machinery.
- Barbirolli** (*bär-bē-rōl'ē*), John (born 1899), Anglo-American musical conductor, born London, of Italian and French parentage; made debut as cellist 1911; founded Barbirolli Chamber Orchestra; conducted British National Opera Company; became permanent conductor New York Philharmonic Symphony Orchestra 1937.
- Barbital**, a narcotic drug N-12 anesthetics A-196
- Barbituric** (*bär-bi-tūr'ik*) acid N-12
- Barbizon** (*bär-bē-zōn'*) School, in painting P-22
- Constable's influence C-346, P-22
- Corot C-370-1, picture F-39
- Millet M-175, picture P-22
- Troyon, picture P-23
- Barbour**, John (1316?-95?), Scottish poet, distinguished for vigorous style and vivid accounts of heroic times; wrote national epic ('The Brus') about Robert Bruce.
- Barbour**, Ralph Henry (born 1870), American writer of boys' books, born Cambridge, Mass.; early stories and poems under pen name Richard Stillman Powell; pleaded cause of clean interscholastic sports ('Half-back'; 'Crimson Sweater').
- Barbuda** (*bär-by'dä*), one of Leeward Islands in British West Indies; 62 sq. mi.; about 250 mi. s.e. of Puerto Rico.
- Barbusse** (*bär-büs'*), Henri (1874-1935), French novelist and journalist; much of his work propaganda for social and political reform ('Under Fire', vivid portrayal of horrors of war).
- Barcarole** (*bär-kä-rōl*), name given to song of Venetian gondoliers; also to music in similar smooth swinging rhythm.
- Barcelona** (*bär-sē-lō'nä*, Spanish *bär-thä-lō'nä*), seaport and chief manufacturing center of Spain; pop. over 1,000,000; B-45-6, map S-226 exposition F-5
- Barclay**, Robert (1648-90), famous Scottish apologist of Quakers; defended doctrine that divine truth is made known through intuition, not logic ('An Apology for the True Christian Divinity').
- Barco** oil field, Colombia C-306
- Barcoo River**. See Cooper's Creek
- Bard College**, formerly St. Stephen's College, at Annandale, N. Y.; for men; Protestant Episcopal; founded 1860; classical, literary, and scientific courses; part of Columbia University.
- Bardia**, town in Libya L-121b
- Bards**, name given to poetic singers among the Celtic peoples, especially in Ireland and Wales; composed verses in honor of heroes and sang them at festivals; term now applied loosely to any poet
- Welsh eisteddfod M-310
- Barebone's Parliament** P-79
- 'Barefoot Boy'**, poem by Whittier W-96
- Bareilly** (*bä-rä'lē*), or Bareilly, India, trade center in United Provinces, 150 mi. e. of Delhi; pop. 145,000; massacre of Europeans in mutiny of 1857: map A-332c
- Ba'rents**, Willem (died 1597), Dutch explorer; discovered Spitsbergen, explored Novaya Zemlya (1596).
- Barents Sea**, part of Arctic Ocean n. of Norway and Russia between Svalbard and Novaya Zemlya; area 942,600 sq. mi.; mean depth 512 ft.: map A-332b
- Barfleur** (*bär-flür'*), a small seaport and summer resort of n.w. France, 15 mi. e. of Cherbourg; important port in Middle Ages.
- Barfrush'**. See in Index Babel
- Bargello** (*bär-gēl'ō*) Palace, in Florence I-168
- Bargone** (*bär'gōn'*), Charles, French author. See in Index Farrère, Claude
- Bar graph** G-136e
- Barham**, Richard II. (1788-1845), English humorist, known as Thomas Ingoldsby ('Ingoldsby Legends', tales in verse).
- Bar Harbor**, Me., summer resort; resident pop. 4378; M-39, map M-38
- Bari** (*bä-rē*), seaport in s.e. Italy on Adriatic; pop. 195,000; ancient Barium; several old churches; extensive commerce and manufactures: map I-156
- Baring**, family of English bankers: firm Baring Brothers, established by Sir Francis (1740-1810) and his brother John became one of the great international banking houses of the world; many of family in public life. See in Index Ashburton; Cromer; Revelstoke
- Baring**, Maurice (born 1874), English writer of distinguished style and great versatility; son of first Baron Revelstoke; war correspondent in Russo-Japanese and Balkan wars; served in air force in first World War; ('Dead Letters'; 'Diminutive Dramas'; 'The Puppet Show of Memory'; 'When They Love'; 'The Coat Without Seam'; 'Robert Peckham'—novels; essays; poems; translations).
- Baring-Gould**, Sabine (1834-1924), English clergyman and writer. A versatile and facile writer, he produced a large number of novels ('John Herring'; 'Melalah'), interesting works on religion, superstitions, and folklore ('Curious Myths of the Middle Ages'), books of travel and history, and many well-known hymns ('Onward Christian Soldiers'; 'Now the Day Is Over').
- Barite**, a mineral (barium sulphate). See in Index Barytes
- Baritone**, or barytone, in music the male voice having a range higher than bass and lower than tenor: diagram S-198
- Bar'ium**, an alkaline earth chemical element A-123, table C-168 chromate forms pigment C-230-1

ü=French *u*, German *ü*; *gem*, *go*; *thin*, *then*; *ä*=French nasal (*Jean*); *zh*=French *j* (*z* in *azure*); *κ*=German guttural *ch*

electrochemical activity E-239
glass making G-102, 104
sulphate (barytes) in paints P-32
sulphide, phosphorescent properties P-176

X-ray diagnosis uses compounds of X-200

Bark, of shrubs and trees B-46, *pictures* T-131. *See also in Index* names of various trees
function P-241
lacking in palms T-131

uses B-46, W-105: canoes B-119, C-76; cork C-365-6; paper M-298; quinine Q-8; spices S-249-50; tanning L-83-4; tapa cloth M-298

Bark, or barque, a sailing vessel S-119
Bar'kantine, also barkentine, a sailing vessel S-119, *picture* S-125

Barker, Eugene C. (born 1874), American historian, born near Riverside, Tex.; professor of American history at University of Texas since 1913; author 'Life of Stephen F. Austin', 'The Austin Papers 1765-1836'; with H. E. Bolton, 'Growth of a Nation'.

Barker, Harley Granville. *See in Index* Granville-Barker

Barking deer, or muntjac D-37

"Barkis is willin'," the famous message sent by the shy carrier in Dickens' 'David Copperfield' to Peggotty, David's nurse, whom he wants to marry.

Barkla, Charles G. (born 1877), British scientist; professor physics, University of London; professor natural philosophy, University of Edinburgh; Nobel prize in physics (1917), for work on electric rays, and X-rays.

Barksdale Field, U. S. Army aviation field near Shreveport, La.; 21,700 acres; headquarters of Third Attack Wing.

Barlach (*bär'lōk*), Ernst (1870-1938), German sculptor and author of philosophical dramas; best known for simple, highly expressive wood carvings of peasants and wanderers.

Bar-le-Duc (*bär-lū-dūk*), France, a quaint old town 125 mi. e. of Paris; pop. 17,000; world famous for its currant jam: *map* M-66

Barley B-46-7
chief producing regions
Europe: France F-174; Russia R-180; Sweden S-338
in United States N-164, S-219, W-124
malt M-43
root, *picture* C-122
rusts and smuts R-199-201

"Barley Break," game P-251, *diagram* P-250, *picture* P-251

Barleycorn, John, personification of intoxicating liquors.

Barleycorn, unit of measure W-66

Barley sugar S-323

Barlow, Howard (born 1892), orchestra conductor, born Plain City, Ohio; one of leading conductors of radio programs; conductor Baltimore Symphony Orchestra.

Barlow, Joel (1754-1812), American poet and politician, born Redding, Conn.; chaplain during Revolutionary War; minister to France 1811; went to Poland for conference with Napoleon and died of exposure when caught in retreat of French army from Moscow; wrote epic 'The Columbiad', in pompous classical style; 'Hasty Pudding', mock heroic still readable.

Barmecides (*bär-mē-sīdz*), Persian family, powerful under early Abba-

sid califs (8th century); "Barmecide's feast," meaning an imaginary banquet, comes from 'The Arabian Nights', where a Barmecide jests at a hungry man's expense by placing empty dishes before him.

Bar'men, town of Rhenish Prussia, Germany, about 26 mi. n.e. Cologne; pop. 187,000; since 1930 combined with Elberfeld to form city of Wuppertal.

Bar'nabas, fellow laborer with the Apostle Paul; his epistle is one of the apocryphal books of the New Testament; commemorated as saint June 11.

'Barnaby Rudge', novel by Dickens (1841), based on the Gordon riots of 1780.

Barnacle, crustacean which lives attached to rocks and ships' bottoms, etc. B-47

Barnacle goose, a wild goose (*Branta leucopsis*) found around n. seas, especially in Europe and Greenland; fabled to have developed from a barnacle.

Bar'nard, Edward Emerson (1857-1923), American astronomer, born Nashville, Tenn.; astronomer Lick Observatory, 1887-95; astronomer Yerkes Observatory and professor astronomy, University of Chicago, 1895-1923. Discovered 16 comets, Jupiter's 5th satellite, and the star with greatest known motion: N-60

Barnard, Frederick A. P. (1809-89), American scientist and educator, born Sheffield, Mass.; president of Columbia College 1864-88; Barnard College named in his honor.

Barnard, George Grey (1863-1938), American sculptor, born Bellefonte, Pa.; some of work outstanding for grace and simplicity; best known for massive, rugged, and forceful works; founded The Cloisters, museum of French medieval art, now a branch of the Metropolitan Museum of Art, in New York City: S-64

influenced by Rodin S-62

'Maidenhood', *picture* S-62

Barnard, Henry (1811-1900), American educator, born Hartford, Conn.; founder and editor of *American Journal of Education*, and first U. S. commissioner of education.

Barnard College, New York City, for women; founded 1889; arts and sciences; part of Columbia University: *picture* N-132

Barnardo (*bär-när'dō*), Thomas John (1845-1905), British philanthropist, founder of over 100 Barnardo Homes which had sheltered and trained as many as 60,000 children by the time of his death.

Barnaul (*bär-nā-gl'*), capital of Barnaul district in southwestern Siberia on Ob River and Turkestan-Siberian railroad; ships farm products, manufactures beet-sugar, glass, and brick; has mining school and meteorological observatory; pop. 150,000: *map* A-332b

Barnburners, nickname of Democratic faction in New York State 1844-52; named for supposed zeal for reform, like the farmer who burned his barn to rid it of rats
nominate Van Buren V-271

Barnby, Sir Joseph (1838-96), English musical composer and conductor (oratorio 'Rebekah'; anthems; hymn-tunes; part-songs; pieces for organ).

Barnes, George Nicoll (1859-1940), British labor leader, engineer by trade; in House of Commons after 1896; minister of pensions 1916-17; in war cabinet 1917-20; labor representative at London Peace Conference.

Barnes, Harry Elmer (born 1889), American educator and writer, born Auburn, N. Y.; lecturer at various American universities; professor historical sociology Smith College ('The Social History of the Western World'; 'Progress of American Penology'; 'The Genesis of the World War'; 'History of Western Civilization').

Barnes, Howard T. (born 1873), Canadian scientist, born Woburn, Mass.; professor physics, McGill University, succeeding Ernest Rutherford; research on engineering problems relating to ice formation in flowing water.

Barnes, Margaret Ayer (Mrs. Cecil Barnes) (born 1886), American novelist and playwright, born Chicago ('Years of Grace', a novel of Chicago, won Pulitzer prize 1931; among other books are 'Prevailing Winds', short stories, and 'Westward Passage', a novel).

Barneveldt (*bär-nē-vēlt*), Jan van Olden (1547-1619), Dutch statesman; secured Twelve Years' Truce with Spain 1609; unjustly beheaded on a charge of treason.

Barney, Joshua (1759-1818), American naval officer, born Baltimore; outstanding service in Revolutionary War; captured British ship *General Monk* off Cape May 1782; in French naval service 1795-1800; commander in defense of Chesapeake Bay 1814.

Barn'helm, Minna von, the clever generous heroine of Lessing's comedy 'Minna von Barnhelm'.

Barn owl O-256, *picture* O-256, *color plate* B-135
scientific name O-257

Barns'ley, England, a market and manufacturing town in Yorkshire, 12 mi. n. of Sheffield; pop. 72,000; coal fields; iron, steel, linen.

Barn swallow S-332, *color plate* B-139

nest, *pictures* B-127, S-333
scientific name S-333

Bar'num, Phineas Taylor (1810-91), American showman B-49, C-237b-c
Dutch Belted cattle herd C-104
gift to Bridgeport B-244
Jumbo, giant elephant E-250, C-237c
Tom Thumb B-49

Barnum and Bailey Circus C-237b-c

Baroda (*bā-rō'dā*), India, trade and railroad center in w. India, 250 mi. n. of Bombay; pop. 115,000; cap. of native state of same name: *maps* I-30, A-332c

Bar'ograph, instrument which registers atmospheric pressure continuously and graphically, used by aviators: B-50, *picture* W-60b

Barója (*bā-rō'hā*), Pío (born 1872), Spanish novelist; honest and independent, writes vividly of his own Basque country; called "Dickens grown sardonic" ('Caesar or Nothing'; 'The Quest'; 'Weeds'): S-237

Barom'eter B-49-50
measuring altitude B-49, 50, *picture* B-48; with balloons B-22, *picture* B-24

readings, corrections B-50

weather forecasting, *picture* W-60b

Bar'on, the lowest order in the British peerage D-34

Key—cāpe, āt, fār, fāst, whāṭ, fāll; mē, yēt, fērñ, thēre; ſce, bīt, rōw, wōn, fōr, nōt, dō; cūre, bāt, rŷde, fŷll, bārñ;

Bar'onet, an inheritable title in Great Britain ranking next below that of baron; the highest degree of honor borne by commoners; abbreviated *Bar't.*: D-34

Barons' Wars, in England, a rebellion of nobles against Henry III, led by Simon de Montfort M-248-9
Prince Edward (Edward I) E-188, M-248-9

Baroque (*bá-rōk'*), or **baroco** (*bá-rō'kō*), the florid, ornate style characterizing fine arts in Europe from middle 16th to middle 18th centuries; developed into gay Rococo style in France
 architecture A-270
 sculpture S-58-9, *picture* S-60

Baroque pearls, pearls of irregular shape P-97

Barque, or **bark**, a sailing vessel S-119

Barr, Amelia E. Huddleston (1831-1919), American novelist, born in England; the best of her 70 stories deal with history of Scotland, England, or Dutch New York ('Bow of Orange Ribbon'; 'Friend Olivia').

Barr, Robert (1850-1912), Scotch-Canadian writer; born Glasgow, Scotland ('A Woman Intervenes'; 'Countess Teckla'; 'The Sword Maker'; 'The O'Ruddy', with Stephen Crane).

Barra (*bár'á*), or **Barray**, island of Outer Hebrides; about 35 sq. mi.; pop. 2000; chief town Castlebay, a fishing center: H-267, *map* E-270a

Barrack emperors, in Roman history, name given by historians to the succession of Roman emperors ruled in power by the army, from reign of Septimius Severus to accession of Diocletian (193-284 A.D.): R-136

Barrauda (*bár-á-ký'dá*), a large, vicious, pike-shaped fish B-50-1

Barrage (*bár'ág*), type of dam D-6 Nile E-196

Barrage (*bá-ráz'h*), a barrier of artillery fire, mines, balloons, or other obstacles to enemy advance
 balloon B-31, *picture* B-27
 submarine mine T-114-16

Barramunda (*bár-á-mún'dá*), a mud-fish or lungfish, native to Australia M-295, *picture* M-296

Barranquilla (*bár-rán-ké'yá*), seaport of Colombia on Magdalena River 7 mi. from mouth; pop. 163,000; terminus of river traffic; exports coffee, hides; produces textiles, shoes, lumber, flour: C-306, *map* S-208b

Barras (*bá-rás'*), Paul, Comte de (1755-1829), French statesman; unscrupulous, time-serving member (1795-99) French Directory.

Barré, Isaac (1726-1802), British politician; colonel in British army; opposed taxing of American colonies; Barre, Vt., Barre, Mass., and Wilkes-Barre, Pa. named for him.

Bar're, Vt., in n. center 5 mi. s.e. of Montpelier; pop. 10,909: V-287, *map* N-86

Barred owl O-256-7, *pictures* O-256, N-33

Barred pickerel P-218

Barrel, a unit of measure, *tables* W-69, 67

Barrel cactus A-290

Barrel organ, or **hand organ**, musical instrument with revolving barrel or cylinder; used by itinerant musicians.

Barrel pen P-104

Barrel roll, in aviation, a lateral corkscrew-like turn in which wings revolve completely around the axis of

the fuselage, the plane meanwhile keeping its forward movement.

Barren Ground caribou C-84

Barren Lands, vast treeless plains or tundras in n. Canada N-151-2, L-72, *map* N-150a

Barres (*bá-rēs'*), **Maurice** (1862-1923), French author and politician; developed from aristocratic dilettante and agnostic into strong nationalist and defender of Catholic church; fine, polished style; admirable travel descriptions ('Faith of France'; 'War and the Spirit of Youth'; 'Sacred Hill'): F-198
 chief works F-199

Bar'rett, John (1866-1938), American diplomat, born Grafton, Vt.; director-general of Pan-American Union, 1907-20.

Barrett, Lawrence (1838-91), American Shakespearean actor long associated with Edwin Booth, born Patterson, N. J.; played Cassius in 'Julius Caesar', Hamlet, King Lear, Shylock.

Barrias (*bá-ré-ás'*), **Louis Ernest** (1841-1905), French sculptor; works show classic spirit combined with strong individuality ('First Burial'; 'Joan of Arc as a Prisoner')
 'The Boy Mozart', *picture* M-295

Bar'rie, Sir James Matthew (1860-1937), Scottish novelist and dramatist B-51, *picture* E-289

'Peter Pan' B-51: Maude Adams in, *picture* D-96

Barrie, Ontario, city and summer resort on Lake Simcoe, about 60 mi. n. of Toronto; pop. 7776; building materials, machine-shop products, flour, boilers, shoes.

Barrier reefs, formed by corals C-364
Great Barrier Reef C-364, *picture* C-363

Barrington, E. See in *Index* Beck, L. Adams

Barron, James (1768?-1851), American commodore, born in Virginia; in command of *Chesapeake* when attacked by British *Leopard*
Chesapeake affair W-8
 killed Decatur D-23

Barrow, Sir John (1764-1848), English traveler and writer; secretary to the British Admiralty 1804-45; did much to promote Arctic exploration ('Travels in China'; 'Travels in Southern Africa').

Bar'row-in-Fur'ness, England, seaport in Lancashire 50 mi. n.w. of Liverpool; pop. 66,000; iron mines; iron and steel works, shipyards: *map* E-270a

Barrow River, 2d largest river of Ireland, in s.e.; flows e. and s. 120 mi. to Atlantic near Waterford: *map* E-279

Barrows, David Prescott (born 1873), American educator, born Chicago; director of education, Philippines; president, University of California, retiring in 1923; lieutenant colonel in Siberia, 1919; major general, California National Guard ('History of the Philippines').

Barry, Sir Charles (1795-1860), English architect, born London; knighted by Queen Victoria 1852; designed Houses of Parliament at Westminster; King Edward's Grammar School, Birmingham, considered finest work.

Barry, Marie Bégu, Countess du. See in *Index* Du Barry

Barry, John (1745-1803), American naval hero B-51-2

Barry, Philip (born 1896), American

playwright, born Rochester, N. Y.; clear, well-constructed plays usually about society people and full of clever dialogue ('White Wings'; 'Paris Bound'; 'Holiday'; 'Hotel Universe'; 'Tomorrow and Tomorrow'; 'The Animal Kingdom').

Barrymore, Ethel (born 1879), American actress, born Philadelphia; made debut in 1896 in company of her uncle, John Drew; married Russell G. Colt; divorced 1923 ('Captain Jinks'; 'Alice-Sit-by-the-Fire'; 'Mid-Channel'; 'Déclassé'; 'The Constant Wife'; 'The Kingdom of God'; 'The Corn Is Green').

Barrymore, Georgina Emma Drew (1856-1893), American actress, wife of Maurice Barrymore and mother of Lionel, Ethel, and John; versatile actress; appeared in plays with husband, also with Edwin Booth; did notable work in 'The School for Scandal', 'L'Abbé Constantin', and 'The Wages of Sin'.

Barrymore, John (1882-1942), American actor; brother of Ethel; made debut in 1903 in 'Magda'; later appeared in 'The Fortune Hunter'; 'Are You a Mason?'; 'Peter Ibbetson'; 'Redemption'; 'The Jest'; 'Richard III'; 'Hamlet'; also famed as motion-picture actor ('Don Juan'; 'Beau Brummel'; 'Svengali').

Barrymore, Lionel (born 1878), American stage and screen actor and motion-picture director, brother of Ethel and John ('The Jest'; 'The Claw'; 'Laugh, Clown, Laugh').

Barrymore, Maurice (1847-1905), English actor, father of Ethel, John, and Lionel; real name Herbert Blythe; leading man for Mme. Modjeska, Mrs. Langtry, Olga Nethersole, Mrs. Fiske.

Bar-sur-Seine (*bár-sür-sén'*), historic town of e. France, on left bank of Seine, 20 mi. s.e. of Troyes; pop. 3000; devastated in 1359 by English and damaged in later wars.

Bartelme (*bár'tél-mē*), **Mary Margaret**, American judge J-232

Barter, exchange of articles without use of money M-220
 American colonies A-158
 ancient Egypt E-204
 fur trade F-224, 225
 international I-111, F-153
 modern Asia A-328, M-222c
 modern cooperatives C-355a
 Nazi economy G-76a
 pioneer America P-221d

Barter agreements, in foreign trade I-111

Barth (*bárt*), **Heinrich** (1821-65), German explorer; published book on travels and discoveries in Africa.

Barthe, Richmond (born 1901), Negro sculptor, born Bay St. Louis, Miss.; work shows original and vigorous realism; many of his pieces in Whitney Museum, New York City, and in U. S. government buildings.

Barthelemy, Peter, a priest in the First Crusade C-403

Bartholdi (*bár-tól-dē'*), **Frédéric A.** (1834-1904), French sculptor B-52
 Liberty statue L-101, B-52, *pictures* L-101, N-124

Bartholomé (*bár-tô-lô-mā'*), **Albert** (1848-1928), French sculptor; designer of the Croix de Guerre medal; noted for group 'To the Dead' at entrance to Père Lachaise Cemetery in Paris.

Bartholomew (*bár-thō'lō-mū*), **Saint**, one of Twelve Apostles; festival August 24: A-229
 fair F-3

massacre of St. Bartholomew's Day C-300, H-354

Barthou (*bār-tō'*), Louis Jean (1862-1934), French statesman and writer; held various cabinet offices; twice premier; foreign minister 1934; assassinated Oct. 9, 1934, with King Alexander of Yugoslavia ('Mirabeau'; 'Le Général Hugo').

Bar'tlesville, Okla., city in n.e.; pop. 16,267; center of Mid-Continent oil field; farming and zinc-smelting interests; natural gas: map O-216

Bartlett, John (1820-1905), American editor and publisher, born Plymouth, Mass. ('Familiar Quotations'; 'Concordance to Shakespeare').

Bartlett, Josiah (1729-95), signer of Declaration of Independence; born Amesbury, Mass.; president of New Hampshire 1790-93, elected governor 1793.

Bartlett, Paul Wayland (1865-1925), American sculptor, born New Haven, Conn.; studied in Paris and exhibited there at age of 14; first chiefly interested in animal sculpture; portrait statues of Lafayette, Gen. Joseph Warren, Benjamin Franklin; six heroic figures for entrance New York Public Library; statues of Columbus and Michelangelo in Congressional Library 'Bear Tamer', picture S-63

Bartlett Dam, in Arizona A-290, table D-357

Bartlett pear P-95

Bartlett, plum P-260

Bartók, Béla (*bār'tōk*) (born 1881), Hungarian composer; used Hungarian folk music and traditional melodies, but his style is strongly modern (opera 'Bluebeard'; dance poems 'Wooden Prince', 'The Wonderful Mandarin'); also author of works on folk-lore.

Bartolini (*bār-tō-lē'nē*), Lorenzo (1777-1850), Italian sculptor; founded school of sculpture at Carrara: S-61

Bartolommeo (*bār-tō-lōm-mā'ō*), Fra (1472-1517), one of the great painters of the Florentine Renaissance; adherent of Savonarola, after whose death he became Dominican monk; excelled in composition and treatment of draperies.

Bartolozzi (*bār-tō-lōt'sē*), Francesco (1725-1815), Italian engraver; born Florence; lived nearly 40 years in London; from 1802 on was head of Royal Academy at Lisbon, Portugal; did line and stipple work with great skill.

Barton, Bruce (born 1886), American writer of popular philosophy, son of William E. Barton; born Robbins, Tenn.; engaged in advertising business; U.S. representative 1937-41 ('More Power to You'; 'The Man Nobody Knows'; 'The Book Nobody Knows'; 'What Can a Man Believe?').

Barton, Clara (1821-1912), founder of American Red Cross B-52

Barton, David (1783-1837), American politician, born Green County, Tenn.; president Missouri Constitutional Convention (1820); one of first two U. S. senators from Missouri (1821-31).

Barton, Sir Edmund (1849-1920), Australian statesman; first prime minister of Australian Commonwealth 1901-03; later member of Federal High Court.

Barton, William Eleazar (1861-1930), American clergyman and writer; born Sublette, Ill.; pastor, First

Congregational Church, Oak Park, Ill., 1899-1924; authority on Lincoln ('Life of Lincoln'; 'The Great Good Man'—young folks' life of Lincoln).

Barto'nia, a small much-branched annual garden herb (*Mentzelia aurea*) with small grayish dentate leaves and large, saucer-shaped, 5-petaled, fragrant yellow flowers.

Bar'tram, John (1699-1777), "Father of American botany," born Chester County, Pa.: P-117-18, Z-226

Baruch (*bār'ryk*), Bernard Mannes (born 1870), American financier, born Camden, S. C.; son of a Spanish-Jewish emigrant who served as a Confederate army surgeon; member, Advisory Commission, Council of National Defense 1916-18; chairman War Industries Board 1918-19; adviser to President Roosevelt on defense problems 1940 and later: R-146q, N-13

Baruch, apocryphal book of Old Testament B-104

Barye (*bā-rē*), Antoine Louis (1796-1875), French sculptor of animals S-60

Barytes (*bā-rī'tēz*), or barite, a heavy crystalline mineral (barium sulphate), white or of varying colors; used in manufacture of insulating material, explosives, shade cloth, printers' ink, rubber tires, and many other substances: A-128 mineral form M-183 paint extender P-32

Barytone, or baritone, in music the male voice having a range higher than bass and lower than tenor: diagram S-198

Basal dragon-fly D-90

Basal metabolism B-118-9

Basalt, a fine-grained, heavy, igneous rock, often solidified into prismatic columns M-184, L-73, pictures I-125, S-46

Basanite. See in Index Touchstone

Bascule (*bās'kūl*) bridges B-240, pictures B-241, B-243

Base, in chemistry A-9, 10 basic lava L-73 electrochemical definition E-239 formed by metals M-122

Base angles G-51

Baseball B-53-7

amateur, picture C-202 bats, made of ash A-323 books on B-57, H-313d Chinese boys playing, picture C-220

Basedow (*bā'zē-dō*), or Basedau, Johann Bernhard (1723-90), German educational reformer; influenced by Rousseau; taught "education according to nature"; founded *Philanthropinum* for training teachers in new education; many of his ideas later carried out by more practical educators ('Elementarwerk').

Basel (*bā'zēl*), Basle, or Bäle (*bāl*), 2d city of Switzerland and chief trade center; on Rhine near n. border; pop. 148,000; originally a Gallic fortified town, then a frontier town of Romans; prominent in Reformation; university founded 1460; manufactures ribbons, silks, jewelry, and chemicals: map S-351 Holbein and Erasmus H-318

Basel, Council of (1431-1439) C-232

Base line, in surveying S-331, L-60

Basel'ia family, or Basellaceae (*bās-ē-lā'sē-ē*), a family of plants, native to the tropics, including Malabar nightshade, Madeira-vine, and ulluco.

Bashan (*bā'shān*), rich district in ancient Palestine, beyond the Jordan; famed for cattle of great size ('bulls of Bashan').

Bashkir (*bāsh-kēr*) Republic, an autonomous republic in extreme east of European Russia; about 54,500 sq. mi.; pop. 3,145,000; cap. Ufa (pop. 245,000).

Bashkirs, a people in Russia of mixed Finnish and Tatar stock, Mohammedan in religion, living in Ural Mts. and neighboring plains.

Bashkirtsef (*bāsh-kért'sēf*), Marie (1860-84), brilliant versatile Russian painter and author; famed after death through her 'Journal'.

Basidiomycetes (*bā-sīd-i-ō-mī-sē'tēz*), class of fungi B-205

Basil (*bāz'il*), the Great, Saint (329-379), early father of Greek church, bishop of Caesarea in Cappadocia; opponent of Arian heresy; founder of Eastern monasticism; festival June 14: M-232-3

Bas'ilar membrane, of ear E-127

Basil'ica (from Greek word meaning "kingly"), term now used for a large rectangular church, usually having aisles and an apse, or for a church so designated by the pope because of historical or religious associations; first basilicas were Greek, then later Roman, public halls: A-263 of Constantine A-262

Basilicata (*bā-zē-lē-kā'tā*), district in s. Italy, now officially called Lucania; includes provinces of Matera and Potenza; pop. 545,000; people speak dialect called basiliisco.

Basilisk, name applied by ancients to an imagined serpent-like monster L-170-1

Bas'illisk, hooded, or helmeted, a lizard L-170-1, I-11

Basin, in physiography P-201-2

Baskerville, John (1706-75), English printer; printed beautiful editions of the Bible, Horace, Vergil, Milton, etc.: T-174 style of type, example B-177

Basket B-57-9 how to make B-59: machinery for, picture B-58

Indian B-58-9, pictures B-58, I-61: Mission Indian I-55

Basketball B-59-62 books on H-313e

Basket boats B-59, B-165, pictures B-168, B-162

Basket cloth, a textile in which two or more threads at a time are woven into the basket-weave pattern.

Basket-fish, a starfish S-277

Basket-flower. See in Index Peruvian daffodil

Basket-Makers, an early American people B-62

Canyon de Chelly N-20 Mesa Verde N-22b

Basket shell S-107, picture S-109

Basket-weave, in textiles, picture T-69, color plate T-63a-b

Basket-work huts S-111, picture P-7

Basle. See in Index Basel

Basques (*bāskz*), people inhabiting the region of the Pyrenees Mts. in n.e. Spain and s.w. France S-227. F-172 legend of Roland R-126

Basra (*bās'rā*), also Bassora, chief port of Iraq (Mesopotamia) on Shatt-el-Arab River, 60 mi. from Persian Gulf; pop. over 60,000; large trade; exports dates; occupied November 1914 by British troops: I-123, maps A-242, A-332b

Bas-relief (*bā-rē-lē'*), basso-rilievo, or low relief, in sculpture S-52, *pictures* S-52, 53, 54, H-268, A-8

Bas-Rhin (*bā rāñ*), department of Alsace A-137

Bass (*bās*), a fish B-63, F-74

Bass (*bās*), in music, the lowest part in a composition; also the lowest male voice and the lowest staff range and vibration, *diagram* S-198

Bassae (*bās'ē*), a place in ancient Arcadia, Greece, near Phigalia. *See in Index* Phigalia

Bassanio (*bās-sā'nē-ō*), in Shakespeare's 'Merchant of Venice' M-119

Bass clarinet W-135

Bass drum D-114, *picture* M-322

Bassedau, Johann. *See in Index* Basedow

Bassein (*bā-sān'*), also Ngawun, Burma, trading town and port in s. on delta of Irrawaddy River; pop. 46,000; mills and exports rice: *map* A-332c

Basse lisse (*bās lēs'*), a tapestry weave T-10

Bas'set, hunting dog D-79, 82

Basse-Terre (*bās-tēr'*), capital of Guadeloupe; pop. 15,000: G-181

Bassett, Richard (1745-1815), Revolutionary War statesman, born Cecil County, Md.; captain of cavalry in Revolutionary War; delegate from Delaware to Federal Convention; U. S. senator 1789-93; governor of Delaware 1799-1801.

Bass horn, or tuba H-338, 339, *picture* M-322

Bassoon, musical instrument W-135, *picture* M-322

Bas'sora. *See in Index* Basra

Bassora gum G-188

Basso-rilievo (*bās'sō rēl-yā'vō*), low relief, or bas-relief S-52, *pictures* S-52-4, H-268, A-8

Bass (*bās*) Strait, channel between Australia and Tasmania; 80 to 150 mi. broad: *map* A-372a

Bass tuba, musical instrument M-323

Bass viol, contrabass, or double bass V-302, *picture* M-322

Basswood, or American linden L-148, *pictures* T-133, 134, 135

Basswood family. *See in Index* Linden family

Bast, fiber L-148

Bastia (*bās-tē'ū*), chief city of Corsica, on n.e. coast; pop. 52,000: *map* I-156

Bastien-Lepage (*bāst-yān'lū-pāzh'*), Jules (1848-84), French painter; a realist, greatly influenced by the Impressionists; among best known works are peasant scenes; also did some notable portraits ('The Hayfield', 'Mme. Sarah Bernhardt', 'Joan of Arc Listening to the Voices', 'The Beggar').

Bastille (*bās-tēl'*, French *bās-tē'yū*), prison fortress in Paris, built in 1369 to protect palace of Charles V destroyed in French Revolution F-202, *picture* F-200

Bastille Day (July 14) H-322

origin, F-202, *picture* F-200

Basting, in sewing S-91

Basu'toland, British crown colony, South Africa, n.e. of Cape Colony; home of the Basutos, a Bantu people; 11,716 sq. mi.; pop. 565,000; cap. Maseru: S-203, *maps* S-202, A-42a

Bat, a winged mammal B-63-4

hibernation H-288, 289

wing, *pictures* H-208, B-63, 64

Bat, in brick masonry B-238

Bat, in pottery making P-328

Bat, or baht, the monetary unit of Thailand; nominally worth about 75 cents; formerly called tical.

Bataan peninsula, Philippine Islands, province of Luzon; rocky jungle land

siege of 1941-42 M-1

Bataille (*bā-tā'yū*), **Henri** (1872-1922), French dramatist; gained prominence with modern plays of love and passion ('Maman Colibri'; 'La Tendresse'; 'La Chair Humaine'; 'La Chambre Blanche', verse).

Batangas (*bā-tān'gās*), P. I., seaport of Luzon 60 mi. s. of Manila; pop. 49,000; U. S. military post: *map* P-10b

Batavia (*bā-tā'vī-ā*), seaport on n. coast of Java, cap. and largest city of Netherlands Indies; pop. 440,000; exports coffee, sugar, tea, rice, spices: J-205, *map* E-142, *picture* J-203

Batavia, N. Y., city 36 mi. n.e. of Buffalo; pop. 17,267; plows, agricultural implements, metal goods, shoes; state school for blind: *map* N-114

Bates, **Arlo** (1850-1918), American writer, born in Maine ('Talks on Writing English'; 'The Diary of a Saint'); professor of English in Massachusetts Institute of Technology 1893-1915.

Bates, **Edward** (1793-1869), U. S. attorney general in Lincoln's cabinet, *picture* L-143

Bates, **Harry** (1850-99), English sculptor, pupil of Rodin ('Socrates', *picture* S-189)

Bates, **Henry Walter** (1825-92), English naturalist; went to Amazon in 1848 with A. R. Wallace and remained there 11 years; won fame by paper on insects explaining mimicry; for many years assistant secretary of Royal Geographical Society ('The Naturalist on the River Amazons').

Bates, **Katharine Lee** (1859-1929), American author, born Falmouth, Mass.; professor English Wellesley College; wrote many books on literature, juvenile stories ('Fairly Gold'), and poems ('America the Beautiful', 'The Pilgrim Ship').

Bates College, at Lewiston, Me.; chartered 1864; arts and letters.

Bateson, **William** (1861-1926), English biologist; prominent advocate of Mendel's theory of heredity; lectured at Yale, Cambridge, and Royal Institution; wrote books and many papers on biological subjects.

Batfish, a fish, also known as sea-bat, belonging to the angler family (*Ogcocephalidae*); has very large broad head, short slender body, and leglike fins; found in all warm seas. The name batfish is also given to the flying sea-robin (*Dactylopterus volitans*), a fish of the gurnard family common on both sides of the Atlantic.

Bath, England, famous watering place 95 mi. w. of London on Avon River; pop. 69,000; hot springs; remains of Roman baths: *map* E-270a

Bath, Me., port and summer resort on Kennebec River 12 mi. from sea, with coastwise and foreign trade; pop. 10,235: M-38-9, *map* M-38

Bath, Order of the D-35 stalls in Westminster Abbey, *picture* W-139

Baths, ancient

Pompeii P-300

Rome R-140, 146, *picture* R-145

Baths and bathing H-376

babies B-1, 2

Bathsheba (*bāth-shē'bā*), wife of Uriah and later wife of King David after David had sent Uriah to his death; became the mother of Solomon (II Sam. xi).

Bathurst (*bāth'ūrst*), Australia, town in New South Wales 110 mi. n.w. of Sydney; pop. 10,000; center of wheat region; gold, copper, silver mines: *map* A-372a

Bathurst, capital of British colony of Gambia in w. Africa; situated on Island of St. Mary in Gambia River; pop. 14,000; deep-water harbor; point of departure for transatlantic airmail planes to Natal, Brazil: *map* A-42a

Bathurst, New Brunswick, summer resort on Chaleurs Bay and Nepisiguit River; pop. 3300; salmon fishery, lumber mills: *map* C-50c

Bathurst Island, large Canadian island in Arctic Ocean, *map* N-150b

Bathurst Island, n. of Australia in Timor Sea, *map* A-372a

Bathysphere, a diving sphere D-72

greatest depth, *chart* A-63

Batik T-66, D-122, *picture* A-327

Batista y Zaldivar (*bā-tēs'tā ē zāl-dē'vār*), **Fulgencio** (born 1901), president of Cuba C-412

Batiste (*bā-tēs't*), a fine, thin, soft cotton or linen cloth; said to have been named from its original maker, a Frenchman named Baptiste; according to other authorities, from its use in wiping the heads of children after baptism.

Baton Rouge (*bāt'ōn ruzh*), La., cap., railroad center, and port on Mississippi River 73 mi. n.w. of New Orleans; pop. 34,719; petroleum, lumber, and chemical products; during Civil War occupied by Federal troops after capture of New Orleans: L-207, M-204, *map* L-206

capitol, *picture* L-205

state university L-204, *picture* L-205

Batrachia, old scientific name for class of animals; now called Amphibia.

Batres y Montúfar (*bāt'rās ē mōn-tū-fār*), **José de** (1809-44), poet of Guatemala L-67v

Batt, **William Loren** (born 1887?), industrialist, born Salem, Ind.; made vice chairman of War Production Board, July 1942; formerly in National Defense Advisory Committee; after 1923 with Swedish-owned S.K.F. Industries, Inc., ball-bearing manufacturers.

Battaks (*bāt'tāks*), a people of Malayan stock in cent. Sumatra; name also given to a negrito tribe of Palawan, P. I.

Battalion, a military unit numbering usually about 1000 men

U. S. Army A-307b

"Battalion of Death," Russian A-140

Bat'tenberg, family name of medieval German counts; revived 1851 for morganatic wife of Alexander of Hesse and princely rank bestowed upon her descendants; Princess Victoria Eugénie married Alfonso XIII of Spain (1906). *See in Index* Alexander, of Battenberg

Battering ram, a war machine used in ancient and medieval times, consisting of a long beam of wood with heavy metal head resembling head of a ram; impelled either by hands of soldiers alone or by ropes suspended from a frame: A-308

Battersea (*băt'ēr-sē*), England, metropolitan borough of s.w. London; pop. 160,000; fine park bordering Thames, 185 acres.

Battery, in artillery unit of four or more guns, corresponding to company in infantry: A-307b

Battery, The, public park in New York City N-124-5
early history N-121, 122

Battery, electric E-214-15, S-293-4.
See also in Index Electric battery

Battle, Mrs., in Lamb's 'Essays of Elia', an enthusiastic whist player who loved "a clear fire, a clean hearth, and the rigor of the game."

Battle, trial by J-231

Battle Abbey, on battlefield of Hastings H-234

Battle above the Clouds, or **Battle of Lookout Mountain** C-157

Battle Creek, Mich., city 44 mi. s.w. of Lansing on Kalamazoo River; pop. 43,453; Battle Creek Sanitarium (established 1866); cereals, printing presses, health foods, wire; railroad shops; Battle Creek College; Camp Custer near by: map M-153
cereal manufactures M-152-3

Battle cruiser N-55

'Battle Cry of Freedom', American Civil War song N-24

Battledore and **shuttlecock**, game played by two persons with small parchment or stringed racket called a battledore, and a shuttlecock of cork stuck with feathers; object to bat shuttlecock and keep it from falling to ground; played for centuries in Orient; modern development called badminton, especially popular in England.

Battlefield sites, National N-22f

'Battle Hymn of the Republic' N-24, picture N-27

'Battle of the Books', by Swift S-344
"Battle of the Nations" (Leipzig) N-10

Battles. A list of the world's greatest battles will be found on the following pages. *See also in Index* names of battles

Battleship N-53-5, N-56a, pictures N-50, 54

airplanes carried N-56, pictures N-54

airplanes vs. battleships N-56a
artillery A-319, N-53-4, pictures A-322, N-50

Dreadnaught begins new era N-56f
named for states, table N-56a
pocket battleship N-56f

Battleship Day (February 15) H-320

Batu, Dutch **Batoe** (*bă'tō*), island group in Netherlands Indies, w. of Sumatra; 445 sq. mi.; pop. 12,000 (Malays); coconuts and other forest produce.

Batum (*bă-təm*'), or **Batumi**, Russia, port of Georgia on Black Sea; pop. 71,000; citrus fruits, tea, bamboo; railroad and oil pipe lines from Baku: maps B-154, E-326e

Batussi, a people of the Belgian Congo, who rule the Bahutu by superior intelligence; have narrower noses and thinner lips than most negroes.

Baucis and Philemon. *See in Index* Philemon and Baucis

Baudelaire (*bôd-lêr*'), Charles Pierre (1821-67), French poet, born Paris; wrote with consummate art, chiefly on morbid, unwholesome subjects, as in 'Fleurs du mal' (Flowers of Evil); translated Edgar Allan Poe into French ('Histoires extraordi-

naires'); also wrote 'Little Poems in Prose'.

Bauer, Andrew, German inventor P-348

Bauer, Harold (born 1873), pianist, born in England of German father and English mother; toured principal cities of Europe; played with leading orchestras in America.

Bauhaus (*bou'hous*), institution founded in Weimar, Germany, 1919, by a group of artists and architects, with Walter Gropius as director; transferred to Dessau 1925; closed by Nazi forces 1933; New Bauhaus (later School of Design) opened in Chicago 1937 by Moholy-Nagy. Its chief aim was to combine practical, manual training in workshops with theoretical instruction in abstract and representative design.

Baum, L. Frank (1856-1919), American author and journalist, born in Chittenango, N. Y.; best known for his 'Wonderful Wizard of Oz' and many other 'Oz' books for children; also wrote 'The Life and Adventures of Santa Claus'; 'Mother Goose in Prose', etc.

Baumes Laws, amendments to New York State criminal code drafted 1926 under leadership of Caleb H. Baumes (1863-1937); drastic measures for prosecution and punishment of crime, including provision that persons convicted of felony for fourth time must serve life sentence.

Baux, Les (*bô, lâ*), a village in s. of France, near Arles; gave name to bauxite ore.

Bauxite (*bôks'it* or *bôz'it*), chief aluminum ore A-139, A-295
chemical composition M-183
world production and consumption, pictographs M-188a, b

Bavaria (*bă-vă'ri-ă*), state in s. Germany; pop. 8,280,000; 29,334 sq. mi.: B-64-5, G-67-9, map G-66
Christmas customs C-229a
Munich M-301-2
Nuremberg N-185-6

Bavarian Alps T-175

Bax, Sir Arnold Edward Trevor (born 1883), English composer; brilliant as a student; composed many piano and orchestra pieces: M-316

Baxter, Elisha (1827-99), governor of Arkansas A-299

Baxter, Richard (1615-91), English Puritan preacher and scholar, called the "chief of the English Protestant Schoolmen" ('The Saint's Everlasting Rest').

Bay, in physiography P-198. For individual bays, *see in Index* name of bay, as Fundy, Bay of

Bay, or bay tree, also called sweet laurel L-72

Bay, or bay tree, also called sweet laurel L-72

Baya (*bă'yă*) bird, a weaver bird of India W-62

Bayard (*bî'ărd*), James Asheton (1767-1815), American statesman, born Philadelphia; U. S. senator, envoy to Russia, member of commission which negotiated Treaty of Ghent with Great Britain.

Bayard (*bă-yăr*'), Pierre du Terrail, Chevalier de (1475?-1524), French military commander in time of Charles VIII, Louis XII, and Francis I; model of chivalry and bravery; called "the good knight without fear and without reproach."

Bayard, Thomas Francis (1828-98), American statesman, born Wilmington, Del.; his great-grandfather, Richard Bassett (1745-

1815), grandfather, James Asheton Bayard (1767-1815), and father James Asheton Bayard II (1799-1880), were all distinguished American statesmen; U. S. secretary of state 1885-89; ambassador to Great Britain 1893-97; his son Thomas Francis Bayard (born 1868), U. S. senator from Delaware.

Bayard, legendary horse owned by the four sons of Aymon, said to have been given them by Charlemagne; celebrated for his swiftness and magical power of lengthening his body.

Bayazid I. *See in Index* Bajazet

Bayberry (*Myrica carolinensis*), a species of wax myrtle, found in e. and s. U.S.; sometimes called candleberry. Grows to 9 ft.; leaves oval; fruit gray white, waxy, used in bayberry wax. California bayberry (*Myrica californica*) native to Pacific coast, grows to 35 ft. in height. Has purple fruit.

Bay City, Mich., important port on Saginaw Bay; pop. 47,956; automobile parts, electrical transformers, cranes, hosiery, boats, lumber products: map M-153

Bayer 205, remedy for sleeping sickness T-148

Bayern (*bî'ēr-n*), German form of Bavaria. *See in Index* Bavaria

Bayeux (*bă-yū'*), France, historic town in Normandy; pop. 7000; famous for old cathedral, rebuilt by William the Conqueror, and for Bayeux tapestry: N-149

Bayeux tapestry, a seamless strip of linen, 230 ft. long and 20 in. wide, covered with 72 colored sketches in worsted embroidery: H-234
not a tapestry T-10

Bay laurel, bay tree, or sweet laurel L-72

Bayle (*bêl*), Pierre (1647-1706), French philosopher and critic; was professor in Sedan and in Rotterdam; his writings, many of which subtly preach that religion and reason are opposed, involved him in many ecclesiastical quarrels and had great influence on the skeptical philosophy of the 18th century ('Historical and Critical Dictionary').

Baylor University, at Waco, Tex.; Baptist; chartered 1845; college of arts and sciences and schools of education, business, law, and music; schools of medicine, dentistry, pharmacy, and nursing at Dallas, Tex.

Bay lynx, or red lynx L-223

Baynes, Ernest Harold (1868-1925), American author and naturalist born Calcutta, India; educated in New York; organized bird sanctuary clubs and took active part in various humane movements; wrote books about his own pets ('The Sprite'; 'Jimmie, the Black Bear Cub'; 'Polaris, the Eskimo Dog').

Bayonet S-358, A-308

Bayonne (*bă-yôn'*), France, historic town and fortress 4 mi. from Bay of Biscay; pop. 31,000; manufacturing and export trade; petroleum and its by-products; 13th-century cathedral; gave name to bayonet, first made here: map F-179

Bayonne, N. J., port on Upper New York Bay; pop. 79,198: N-91, map N-90

Bayou (*bî'yū*), how formed L-55
Mississippi River M-204

Bayou State, popular name for Mississippi.

Fact-Index

SOME OF THE WORLD'S MOST IMPORTANT BATTLES

- Actium** (31 B.C.): Sea battle between forces of Octavian and those of Mark Antony. Victory of Octavian made him first emperor of Rome and thereby founder of the Roman Empire.
- Adrianople** (378): Visigoths defeated the Roman legions under Valens and settled within the borders of the Eastern Roman Empire. Broke Roman superiority and inspired other Gothic nations to make inroads which led to the collapse of the Western Roman Empire.
- Aegospotami** (405 B.C.): Sparta captured the Athenian fleet; led to downfall of Athenian Empire.
- Agincourt** (1415): Henry V of England decisively defeated the French, proving finally the superiority of the English longbowmen over the armored knights of France.
- Arbela** (331 B.C.): Alexander the Great finally defeated Darius III of Persia, and became master of Asia.
- Armada, Spanish** (1588): Flotilla of nimble English ships defeated great Spanish war fleet in English Channel; deathblow to Spain's mastery of the seas.
- Artemisium** (480 B.C.): Greeks in a naval battle defeated Persians under Xerxes.
- Austerlitz** (1805): "Battle of Three Emperors"; Napoleon defeated united forces of Russia and Austria under Alexander I and Francis II.
- Bannockburn** (1314): Robert Bruce of Scotland defeated the English in a decisive battle, making his throne and Scotland's independence secure.
- Blenheim** (1704): English and Austrians under Marlborough and Eugene defeated French and Bavarians under Tallard in War of Spanish Succession; dissipated Louis XIV's dreams of universal conquest.
- Bosworth Field** (1485): Final battle of the War of the Roses. Henry, Earl of Richmond, defeated Richard III. Henry became Henry VII and established Tudor line.
- Bouvines** (1214): French under Philip Augustus defeated allied English, German, Flemish, and Lotharingian forces. Strengthened growth of French national spirit.
- Boyne** (1690): William of Orange defeated the Stuart forces under James II. Ended any substantial prospect of restoration of the Stuart rule.
- Bunker Hill** (1775): American colonists, though forced to retreat, won a practical victory over the British; first real battle of the American Revolution.
- Cannae** (216 B.C.): Frightful battle in which Hannibal annihilated great Roman army; Rome's existence threatened.
- Chaeronea** (338 B.C.): Philip of Macedon gained mastery of all Greece.
- Châlons** (451): Romans and Visigoths under Aetius and Theodoric checked Attila's advance in France, saving W. Europe from the Huns.
- Chioggia** (1380): Naval battles between Venetians and Genoese. Capture of Genoese fleet gave Venice maritime supremacy.
- Crécy** (1346): Edward III and English longbowmen won victory over a vastly superior French army of cavalry; greatly strengthened England's position in France.
- Culloden Moor** (1746): Duke of Cumberland defeated Charles Edward, the Young Pretender. Last attempt of the Stuarts to regain the English throne.
- Gettysburg** (1863): Union troops under Meade sharply defeated Lee, forcing his retreat from Northern soil; one of decisive battles of Civil War.
- Hastings** (1066): William, Duke of Normandy, defeated English, their king, Harold, falling in battle; established Norman rule over England.
- Jutland** (1916): Most important naval conflict of first World War, in North Sea; after heavy losses on both sides, British fleet, under Jellicoe and Beatty, forced retreat of German vessels.
- Lake Erie** (1813): Naval battle at Put in Bay, Ohio. Americans under Commodore Perry defeated the British fleet. Secured the Northwest to U.S. in Treaty of Ghent.
- Leipzig** (1813): Swedes and Saxons under Gustav Adolphus won brilliant victory over Catholic Imperialists, and saved Protestant cause in Thirty Years' War; also called Breitenfeld.
- Leipzig** (1813): "Battle of the Nations"; overwhelming defeat inflicted upon Napoleon by allied forces; marked end of French rule in Germany; turning point in Napoleonic wars.
- Lepanto** (1571): Venetian and Spanish fleets under Don Juan of Austria decisively defeated Turkey in Gulf of Corinth, ending Turkish sea power.
- Lützen** (1632): Gustavus Adolphus, king of Sweden, won a brilliant victory over the Imperialist forces under Wallenstein, but the Swedish leader was himself slain.
- Manila Bay** (1898): Dewey, American admiral, destroyed Spanish fleet in harbor and took forts and city without loss.
- Manzikert** (1071): Seljuk Turks defeated Romanus Diogenes, emperor of the Eastern Roman Empire. Opened most of Asia Minor to Turkish conquest.
- Marathon** (490 B.C.): Miltiades with a small force of Athenians and Plateans, routed large Persian army, saving Greece from Asiatic conquest.
- Marne, First Battle of the** (1914): French and British forces under Joffre and French checked German invasion in four-day battle and drove them back to Aisne River, where battle line remained nearly stationary for three years.
- Marne, Second Battle of the** (1918): Counteroffensive launched by Foch with French and American troops; placed Germans permanently on defensive.
- Marston Moor** (1644): Cromwell's Ironsides defeated the Royalists and gained the north of England for Parliament.
- Megiddo** (1479): Thutmose III of Egypt defeated confederated kings of Syria and Mesopotamia. Marks highest point of Egyptian conquest. Fought on battlefield of Armageddon.
- Metaurus** (207 B.C.): Romans under the consul Nero defeated Hasdrubal (who was slain) and his Carthaginians, thus preventing the union of Hasdrubal and Hannibal, saving Italy.
- Meuse-Argonne** (1918): In battle lasting 47 days, Americans under Pershing fought through Argonne Forest, broke through German lines, and crossed the Meuse River. Considered by Germans as decisive factor in their defeat in first World War.
- Milvian Bridge** (312): Constantine the Great defeated Maxentius and became sole ruler of the Western Roman Empire. *See in Index Hoc signo vince*
- Mohács** (1526): Solyman the Magnificent of Turkey defeated Hungary, and led his army to gates of Vienna.
- Mukden** (1905): Japanese defeated Russians under Kuropatkin.
- Nile** (1798): Naval battle in Aboukir Bay, Egypt; Nelson destroyed French fleet, cutting off Napoleon from France.
- Orleans** (1429): Joan of Arc raised English siege; turning point in Hundred Years' War.
- Pharsalus** (48 B.C.): Decisive victory of Caesar over Pompey. Established Caesar as sole ruler of Rome.
- Plassey** (1757): British under Clive defeated forces of Suraj-ud-Dowlah, nawab of Bengal; established British rule in India.
- Plataea** (479 B.C.): Greeks defeated the Persians and ended their attempt to invade Greece.
- Plevna** (1877): After five months' siege the Russians forced the surrender of this pivotal strategic point by the Turks, virtually concluding Russo-Turkish War.
- Poitiers** (1356): Victory of Black Prince over King John of France; many prisoners taken, including John; ended first period of Hundred Years' War.
- Poltava** (1709): Peter the Great of Russia completely defeated Charles XII of Sweden, annihilating his army; Russia succeeded Sweden as the leading power of the north at conclusion of the Great Northern War.
- Quebec** (1759): British under Wolfe stormed and took Quebec after gallant defense by French general, Montcalm, securing British domination of North America.
- Sadowa** (1866): Crushing defeat administered to Austria by Moltke; led to exclusion of Austria from German Confederation; also called Königgrätz.
- Salamanca** (1812): English under Wellington completely defeated the French. Ended Napoleon's Peninsular Campaign.
- Salamis** (480 B.C.): Athenian fleet built by Themistocles almost annihilated Persian fleet; forced withdrawal of Xerxes from Greece.
- Santiago** (1898): American fleet commanded by Sampson destroyed Spain's Atlantic fleet under Cervera, forcing surrender of Spanish army in Cuba.
- Saratoga** (1777): Surrender of Burgoyne and his British army to American general, Gates; turning point in Revolutionary War.
- Sea of Japan** (1905): Japan destroyed Russian navy and became a world power; also called Tsushima.
- Sedan** (1870): Prussians under Moltke defeated MacMahon and forced surrender of Napoleon III and 100,000 men; caused fall of French Empire and proclamation of Third Republic.

ü=French u, German ü; gem, go; thin, then; ñ=French nasal (Jean); zh=French j (z in azure); κ=German guttural ch

SOME OF THE WORLD'S MOST IMPORTANT BATTLES—*Concluded*

Sempach (1386): Swiss defeated Austrians under Duke Leopold. Broke Austrian power over Swiss Confederacy. *See in Index* Winkelried, Arnold

Sluys (1330): English and Flemish fleets under Edward III of England defeated the French and won command of the English Channel.

Solferino (1859): France and Sardinia-Piedmont under Napoleon III defeated the Austrians; the horror of this battle influenced Napoleon to make peace.

Somme (1916): English and French took offensive for five months; made small gain in territory at enormous cost, but relieved Verdun and aided Russia in gaining eastern victory.

Syracuse (413 B.C.): Syracusans with Spartan aid destroyed Athenian fleet, dealing a deathblow to Athens' naval supremacy and contributing to its defeat in the Peloponnesian War.

Tannenberg (1914): Hindenburg stopped the Russian invasion of East Prussia.

Teutoburger Wald (9 A.D.): Germans under Arminius (Hermann) annihilated Roman army commanded by Quintilius Varus; established Rhine and Danube as northern Roman frontier.

Thermopylae (480 B.C.): Heroic effort of Leonidas and a small body of Spartans to check Persian hordes of Xerxes in their march on Athens; Athens destroyed.

Tours (732): Charles Martel and the Franks forced the retreat of the Saracens, saving western Europe from Moslem invasion.

Trafalgar (1805): Nelson destroyed the combined French and Spanish fleets, firmly securing England's sea power, the chief menace to French conquests.

Valmy (1792): French commanded by Dumouriez defeated troops of "First Coalition" under Brunswick, saving revolutionary government from destruction at hands of invaders.

Verdun (1916): General Pétain retained fort in spite of supreme effort by Germans, thus keeping barred the road to Paris and increasing the confidence of the Allied forces.

Wagram (1809): Napoleon crushingly defeated the Austrians.

Waterloo (1815): English, Prussians, and allies under Wellington and Blücher effected final overthrow of Napoleon.

Yorktown (1781): Americans and French under Washington forced surrender of Lord Cornwallis with 7,000 men, practically ending Revolutionary War.

Ypres, First Battle of (1914): British prevented Germans from reaching Calais and occupying channel ports.

See also in Index Sieges, table

'Bay Psalm Book' M-316

Bayreuth, or Baireuth (bi-roit'), Germany, city in Bavaria, 126 mi. n. of Munich; pop. 35,000; home of composer Wagner; Wagnerian musical festivals: W-1, map G-66
Liszt at L-157

Bay rum, a toilet preparation made by mixing oil of bay with diluted alcohol and adding oil of allspice and oil of orange peel; original bay rum from West Indies.

Bay State, or Old Bay State, popular name for Massachusetts.

Bay tree. *See* California laurel

Bay-winged bunting, or vesper sparrow B-273, S-238

Bazaar, oriental market place

Cairo C-15-16

Damascus D-9

Delhi D-42-3

Peking P-102

Bazaine (bâ-zên'), François Achille (1811-88), French marshal; commander in chief of the main French armies in Franco-Prussian War; in 1873, condemned by a military court of surrendering without sufficient cause, he was sentenced to life imprisonment. He escaped in 1874 and lived in Spain until his death siege of Metz M-131

Bazan (bâ-thân'), Emilia Pardo. *See in Index* Pardo Bazan

Bazin (bâ-zân'), René (1853-1932), French novelist, born near Angers, France; novels depict wholesome family life and the peasants' love for the soil ('La Terre Qui Meurt'; 'Le Blé Qui Lève').

Bazooka, U. S. Army's rocket anti-tank gun, aimed like a rifle and served by two men. When the rocket shell strikes tank armor, a fierce incendiary charge in the nose burns through the metal and the shell explodes inside the tank.

B complex, vitamin V-310-11a, 312

Beach, Amy Mavey Cheney (Mrs. H. A. Beach) (born 1867), American pianist and composer, born Henniker, N. H.; wrote for orchestra ('Gaelic Symphony'); choral works ('The Minstrel and the King'; 'The Chambered Nautilus'); piano pieces; many songs.

Beach, Chester (born 1881), American sculptor, born San Francisco,

Calif.; works show originality in ideas, power in execution.

Beach, Rex (born 1877), American author, born Atwood, Mich.; educated at Rollins College, Fla.; studied law in Chicago, but gave this up when his stories became successful; novels of adventure ('The Spoilers'; 'The Barrier'; 'The Ne'er-do-Well').

Beach-combers P-8

Beachy Head, chalk cliff (532 ft.) in Sussex, England, 3 mi. from Eastbourne; nearby Dutch and English fleet defeated (1690) by French.

Beacon (bê-kôn'), N. Y., a city on Hudson River opposite Newburgh, in farm and fruit region; pop. 12,572; clothing, rubber goods, paints.

Beacon, a guiding signal
airplane A-76, 78, E-234-5, picture A-77

ancient T-30, pictures T-31

lighthouses L-132

Lindbergh beacon, Los Angeles L-198

Palmolive beacon, Chicago C-191

radio A-76, 78, N-47, pictures A-77

Beacon Hill, Boston B-200

Beaconsfield (bê-kînz-feld or bêt'-ûnz-feld), Earl of. *See* Disraeli

Beadle, William Henry H. (1838-1915), American pioneer and educator, born Indiana; brigadier general, Civil War; president State Normal, Madison, S. D., 1889-1906 education in S. D. S-220-21

Beads

ancient glass G-101

Indians use as money S-108

manufacture in America begun G-106

Bead tree, a genus (*Melia*) of trees native to Australia and e. Asia; includes Texas umbrella tree (25 to 40 ft. high); flowers purple, in clusters; fruit yellow.

Beagle, a hound D-79, 82

'Beagle', ship in which Darwin made voyage around world D-15, 16

Beak

birds, color plate B-130: duck, picture D-116; parrot, color plate P-83-4; toucan T-116, color plate B-130

boll-weevil, picture C-378

bug distinguished by I-87

fish F-70, picture F-70: cuttlefish,

picture C-416; octopus C-417

flea F-106

Beaked whale W-80

Beam, in architecture, a horizontal piece of wood, stone, or metal, used to support overhead weight or resist sideways thrust

Babylonians lacked A-257

Egyptian, picture A-258

Greek architecture developed A-260,

picture A-259

truss alternate form A-273

Beam, of electrons T-41

Beam transmission, in radio R-24-5,

27, M-62

airplane guidance A-76, picture A-77

Bean, William (flourished 1760), pioneer, born Virginia; accompanied Boone to Kentucky in 1760

settles in Tennessee T-48

Bean, certain leguminous plants especially of the genera *Phaseolus* and *Vicia* and their seed; name also applied to other bean-shaped seed and to the plants bearing them, such as the castor bean: B-65-7 food value B-65: compared to milk, picture M-172; phosphorus P-177 geotropism P-241

germination and growth, pictures B-66

nitrogen gatherer N-147

planting directions G-13

seed structure S-75, pictures B-66

varieties B-65-7: soy S-224

Bean beetle, Mexican, an insect pest; best treated by spraying with magnesium arsenate or by dusting with calcium arsenate and copper lime dust: I-90

Bean family (Leguminosae). *See in Index* Legumes

Beard B-67-9

black B-68, picture B-68

brown: Alaskan B-69; European

B-69, picture B-69

characteristics and habits B-67

cinnamon B-68

den, picture Z-225

emblem of Bern B-100

food habits B-67

foot, pictures F-147, B-67

glacier B-68

grizzly B-68-9, picture B-69

hibernation H-288, B-67: polar bear

B-69

Ice Age animal I-2a

intelligence B-67

length of life, average, pictograph

A-198

Key—câpe, ât, fâr, fâst, whâf, fâll; mē, yēt, fērn, thêre; îce, bît; rōw, wôn, fôr, nôt, dâ; cûrs, bût, rûde, fûll, bârn;

polar B-69, *pictures* B-69, Z-219, Z-225
 price paid for by zoos Z-221
 spectacled. *See in Index* Spectacled bear
 tree climbing B-67
 weight B-67, 69
 young B-67: polar bear B-69
 Bear, in finance B-161
 Bear, Great (Ursa Major), and Bear, Little (Ursa Minor), constellations C-347, *charts* A-341, S-275a, c, d, f, g
 Bearbaiting, an old sport in which chained bears were attacked by dogs.
 Bearberry, a small trailing shrub (*Arctostaphylos uva-ursi*) of the heath family with thick evergreen leaves and clusters of small white flowers followed by bright red inedible berries.
 Bear cat, or great panda Z-222
 Beard, Charles Austin (born 1874), American historian, born near Knightstown, Ind.; professor politics, Columbia University 1915-17; stressed economic basis of political institutions; wrote 'The Economic Interpretation of the Constitution', and other books on history and politics, and (with his wife Mary Beard) 'The Rise of American Civilization'.
 Beard, Daniel Carter (1850-1941), American artist, author, naturalist, and outdoor enthusiast; born Cincinnati, O.; author of books on camp lore, woodcraft, and outdoor life; pioneer in Boy Scout movement; organized Sons of Daniel Boone, forerunner of Boy Scouts of America ('American Boys' Handy Book'; 'Dan Beard's Animal Book'; 'The Buckskin Book for Buckskin Men and Boys'): H-313a
 Beard, Thomas, first American shoemaker; emigrated from London and settled at Salem, Mass.: S-131
 Beard, also called awn barley, *picture* B-47
 wheat W-84, *picture* W-82
 Bearded seal S-70
 Bearded vulture, or lammergeier V-336
 Beardmore Glacier, Antarctica A-214, 217, *map* A-215
 Beardsley, Aubrey Vincent (1872-98), English artist; works are fantastic and highly decorative; best known for his unique handling of black and white in line and mass; illustrated Pope's 'The Rape of the Lock' and Oscar Wilde's 'Salome'.
 Beard tongue, a genus (*Penstemon*) of perennial plants of the figwort family with tubular flowers in a wide range of colors; leaves usually oblong and opposite; more than 100 species in North America
 how to plant G-7-8, 11
 Bear Flag Revolt, rising against Mexican government (1846) by U. S. immigrants in Calif.; so called from flag with grizzly bear declaring California a republic: C-33
 Bear-grass, a variety of yucca Y-211
 Bearing metals, any of the antifriction alloys used for machine bearings: A-132
 Bearings. *See in Index* Navigation, list of terms
 Bearings (machinery)
 antifriction metals A-132
 crystal structure A-133
 lubrication, reason for L-211, P-193
 Bear Mountain, highest point in Connecticut (2355 ft.).
 Bear Mountain Bridge, N. Y., *table* B-342
 Bear River, in Utah and Idaho, flows in tortuous course of 450 mi. from

Uinta Mts. to Great Salt Lake, *map* U-264
 Bear State, popular name for Arkansas.
 'Bear Tamer, The', statue by Bartlett, *picture* S-63
 Beast-epic, a popular medieval literary form, consisting of a series of stories attributing human qualities to animals; often satires on human behavior; origin is disputed, but stories grouped around Reynard the Fox, Bruin the Bear, Chanticleer the Cock, and others, were popular in n. France, w. Germany, and in Flanders in the 12th century
 Chanticleer, *picture* S-303j
 Chaucer's tale C-161
 'Reynard the Fox' F-166, S-303i, *picture* S-303j
 Beasts of burden T-121. *See also in Index* Pack Transportation
 Beat, electrical R-22
 Beat, of sound S-197
 "Beater Goes Round," or "Drop the Handkerchief," game P-248
 Beatification. *See in Index* Canonization
 "Beating to windward," in sailing, *picture* E-165
 Beaton (*bē'tōn* or *bā'tōn*), or Bethune, David (1494?-1546), only Scottish cardinal; able but unscrupulous statesman, arrogant, cruel, and immoral: K-37
 Beatrice (*bē'ā-trīs*), in Shakespeare's 'Much Ado About Nothing', clever, vivacious, scornful girl who falls in love with the scoffing Benedick, her professed detestation.
 Beatrice (*bā-ā-trē'chā*), in the 'Divina Commedia', the "glorious lady" of Dante's mystic adoration, and his guide through Paradise; identified with a certain Beatrice Portinari (1266-90) whom he saw when they were both children, and but seldom thereafter: D-11, 12
 Beatrice, Neb., city 38 mi. s. of Lincoln; pop. 10,883; in stock-raising, farming, and dairying region; important trading center; silos, steel tanks, windmills, pumps: *map* N-57
 Beattie (*bē'ti* or *bā'ti*), James (1735-1803), Scottish poet and philosopher; professor of moral philosophy, Marischal College, Aberdeen; his 'Essay on the Nature and Immutability of Truth', which opposed the skepticism of Hume, made him famous, as did his descriptive poem in Spenserian stanza, the 'Minstrel'.
 Beatty (*bē'tē*), David, first Earl (1871-1936), commanded British Grand Fleet in first World War B-69-70
 Dogger Bank battle W-158
 Beaubien, Jean Baptiste (1787-1863), early Chicago settler, born Detroit, Mich.; bought house in Chicago in 1817; worked for American Fur Co.; in 1830's attempted to gain title to Fort Dearborn reservation.
 Beau Brummell. *See* Brummell
 'Beaucaire (*bō-kēr*), Monsieur' title and hero of romance by Booth Tarkington.
 Beauchemin (*bō-shū-mān'*), Nérée (1850-1931), Canadian poet; wrote 'Les floraisons matutinales': C-66
 Beaufort scale, for describing wind velocity, devised by Admiral Sir Francis Beaufort (1774-1857): W-113
 Beaugency (*bō-zhān-sē*), France, historic town on Loire River 15 mi. s.w. of Orléans; pop. 3000; victory of Joan of Arc over English (1429); French defeated in Franco-Prussian

War; cloth and leather; grain trade.
 Beauharnais (*bō-ār-nē'*), Alexandre, Vicomte de (1760-94), first husband of Josephine (later empress): J-227-8
 Beauharnais, Eugène (1781-1824), son of Empress Josephine J-228
 Beauharnais, Hortense (1783-1837), daughter of Empress Josephine, and wife of Louis Bonaparte J-228
 Beaumarchais (*bō-mār-shē'*), Pierre Augustin Caron de (1732-99), French politician, dramatist, and satirist; aided American Revolutionists ('Barber of Seville'; 'Marriage of Figaro').
 Beaumont (*bō'mōnt*), Francis (1584-1616), English dramatist whose association with John Fletcher formed a "perfect union in genius and friendship" which has left their names inseparably connected ('Philostratus'; 'The Maid's Tragedy'): D-94
 quoted W-72
 Beaumont, William (1785-1853), American army surgeon, born Lebanon, Conn.; famous for discovery of laws of digestion: S-292
 Beaumont, Tex., port on Neches River 30 mi. from Gulf of Mexico; pop. 59,061; owes its rapid growth (pop. 9427 in 1900) to discovery of oil; lumber center; rice milling, iron works; shipbuilding: *map* T-56
 canal to Port Arthur, *table* C-433
 Beauregard (*bō'rē-gārd*), Pierre Gustave Toutant (1818-93), Confederate general; surrendered with Johnston to Sherman (1865)
 Fort Sumter attacked by F-161
 Beauty, meaning in art F-41
 "Beauty is truth" K-9
 Beauvais (*bō-vē'*), France, cap. of Oise, 42 mi. n.w. of Paris; pop. 19,000; Gobelin tapestry, textile manufactures; famous cathedral begun in 13th century
 tapestry, *picture* T-11
 Beauvais tapestry, *picture* T-11
 Beauvoir (*bō-vvār*), last home of Jefferson Davis, 1877-89; located between Biloxi and Gulfport, Miss., overlooking Gulf of Mexico. Now a state-supported home for Confederate veterans, their wives and widows.
 Beaux (*bō*), Cecilia (1863-1942), American painter, born Philadelphia; free and easy technique, good composition, and skilful illumination make her figures and portraits highly pleasing ('Mrs. Theodore Roosevelt'; 'Cynthia'; 'Ernesta and Her Little Brother').
 Beaux, Les (*bō, lā*), a village in s. of France, near Arles; gave name to bauxite ore.
 Beaux-Arts, École des. *See in Index* École des Beaux-Arts
 Beaver B-70-2
 community life B-70; *picture* B-71
 dam building and tree felling B-70-1, A-202, *pictures* B-71
 distribution B-71
 fur in settlement of U.S. U-184
 for B-71, F-225
 giant fossil type A-210
 hats B-71, F-225
 protection B-71-2
 skin used as money F-225
 water table level and B-145
 yields castor perfume P-124
 Beaverbrook, William Maxwell Aitken, first Baron (born 1879), British publicist, capitalist, and newspaper publisher; born New Brunswick, Canada; amalgamated Canadian

ü=French u, German ü; gem, go; thin, then; ñ=French nasal (Jean); zh=French j (z in azure); κ=German guttural ch

cement industry, 1910; 1st World War represented Canadian government; raised to peerage 1918; in 2d World War British minister of aircraft production and later minister of state and British-American lend-lease coördinator; made Lord Privy Seal (for postwar civil aviation problems) Oct. 1943; chief owner of London *Daily Express*, *Evening Standard*, and *Pall Mall Gazette*; wrote 'Politicians and the War'.

Beaver cloth, thick woolen fabric with napped finish similar to broadcloth.

Beaver Dam, Wis., city 55 mi. n.w. of Milwaukee; pop. 10,356; shoes, ranges, and refrigerators; pea and corn canneries.

Beaver Dam Creek, battle of. *See in Index* Mechanicsville

Beaver Falls, Pa., city on Beaver River 28 mi. n.w. of Pittsburgh; pop. 17,098; abundant water power and coal for manufacturing; iron and steel, clay, pottery, cork products; Geneva College.

Beaver State, popular name for Oregon.

Bebel (*bā'bēl*), Ferdinand August (1840-1913), German socialist; helped form German Social Democrat party.

Beccaria (*bēk-kā-rē'ā*), Cesare (1735-94), Italian publicist and political economist whose 'On Crimes and Punishments' had immense influence in removing barbarous punishment from penal codes.

Bêche-de-mer (*bēsh-dū-mēr*), trepang, or sea-cucumber, a marine animal S-67

Bechuanaland (*bēch-y-ū'nā-lānd*), name of regions in South Africa including Bechuanaland Protectorate (area 275,000 sq. mi., pop. 265,000) and British Bechuanaland (annexed to Cape of Good Hope Province in 1895). The Protectorate is administered from Mafeking, Cape of Good Hope Province; chiefs rule their own people under a British royal commissioner; cattle raising is the chief industry: S-203, *maps* S-202, A-42a

Rhodes in S-202

Beck, Sir Adam (1857-1925), Canadian legislator, born Baden, Ont.; had been successful manufacturer; elected to legislature (1902-19 and 1923-25); became identified with work of developing and distributing power generated at Niagara Falls; chairman Ontario Hydro-Electric Power Commission.

Beck, L. Adams (Mrs. Lily Adams Beck) (died 1931), Canadian author; daughter of English admiral, John Moresby; lived for years in Orient; wrote historical novels as E. Barrington ('Glorious Apollo', 'The Divine Lady'), oriental tales as L. Adams Beck ('The Key of Dreams'), adventure and South Sea stories as L. Moresby.

Becke, George Lewis ('Louis Becke') (1855-1913), Australian writer, best known for stories of life in islands of s. Pacific ('By Reef and Palm'): A-376

Becker, May Lambertson (born 1873), American editor, critic, and lecturer, born New York City; at age of 18 wrote dramatic and musical criticism; editor 'Readers' Guide' in New York *Herald Tribune*; book editor, *The Scholastic*. Compiled 'Golden Tales of the Old South', 'Golden Tales of New England', and other collections of regional short

stories; author of 'Adventures in Reading', 'Books as Windows', 'Choosing Books for Children'.

Beck'et, Thomas (1118-70), archbishop of Canterbury B-72

Becket, Thomas à, English actor, in Philadelphia in 1843; supposed author of 'Columbia, the Gem of the Ocean'.

Beckford, William (1760-1844), English writer, author of 'History of Caliph Vathek' (oriental romance, written in French) and of books of travel; wealthy and eccentric, he built a magnificent residence at Fonthill Abbey, where he lived alone.

Beckley, W. Va., city in Appalachian highlands, 46 mi. s.e. of Charleston, in center of 'smokeless coal' region; pop. 12,852; seat of Raleigh County.

Beckwith, James Carroll (1852-1917), American painter, born Hannibal, Mo.; best represented by his portraits ('The Authoress', 'Mrs. Beckwith', 'Mark Twain').

Becky Sharp, in Thackeray's 'Vanity Fair', clever, fascinating, unscrupulous adventuress.

Becque (*bēk*), Henri François (1837-99), French dramatist; pioneer in naturalism in French drama; presents episodes from ordinary life, with little attention to plot ('The Woman of Paris').

Becquerel (*bēk-rēl'*), Alexandre Edmond (1820-91), French physicist, son of Antoine César; noted for researches in electricity and light; invented phosphoroscope.

Becquerel, Antoine César (1788-1878), French physicist, first of distinguished family; one of founders of electrochemistry.

Becquerel, Antoine Henri (1852-1908), son of Alexandre E. Becquerel; shared Nobel prize with Pierre and Marie Curie (1903); discoverer of radioactivity: R-32

Becquerel rays R-32

Bed

American colonial A-169, *picture* A-170

camp bedding C-44

Chinese C-215

developed from chest I-98

Japanese, *picture* J-199

medieval S-112

modernistic, *picture* L-59

period types I-101, 105, *pictures* I-98, 100

pioneer Northwest, *picture* P-221d

sizes standardized U-226

Bed-and-platen printing press P-347

Bed-bug, a small, flat, blood-sucking insect (*Cimex lectularius*), of reddish brown color, parasitic on man.

Beddoes (*bēd'ōz*), Thomas (1760-1808), English physician and scientific writer; established "pneumatic institute" for treating disease by inhalation of different gases

Davy and D-21

Beddoes, Thomas Lovell (1803-49), English dramatist and poet, son of above; lyrics show influence of Shelley ('Death's Jest-Book'; 'The Bride's Tragedy').

Bede (*bēd*), Beda (*bā'dā*), or Baeda (673?-735), English monk known as "The Venerable Bede," and "Father of English History"; gentle, pious, humble scholar, greatest in Saxon England ('Ecclesiastical History of the English Nation', chief source of information for period covered); commemorated as

saint May 27
translates Gospel of St. John B-101-2

Bedford, Francis (1800-83), English bookbinder B-183

Bedford, Gunning, Jr. (1747-1812), Revolutionary War statesman, born Philadelphia; represented Delaware in Continental Congress and at Constitutional Convention; U. S. judge for Delaware district 1789-1812.

Bedford, John, Duke of (1389-1435), son of Henry IV of England and brother of Henry V; protector of England and regent of France in reign of Henry VI. In Shakespeare's 'Henry IV' he is the sober sensible Prince John of Lancaster, foil for wild Prince Hal.

Bedford, England, cap. of Bedfordshire on Ouse River 45 mi. n.w. of London; pop. 41,000; famous grammar school founded 1552; home of John Bunyan: *map* E-279

vocational education, *picture* V-314

Bedford, Ind., 65 mi. s.w. of Indianapolis; pop. 12,514; center of great limestone quarries: *map* I-46

Bedford, Mass., small village n.w. of Boston, near Concord; pop. 3807

flag of Minute Men F-99, *color plate* F-90

Bedford limestone, or Indiana limestone L-138, Q-3

quarry, *picture* I-49

Bedfordshire, s. midland county of England; 473 sq. mi.; pop. 220,000; agriculture, stock raising.

Bédier (*bād-yā*), Joseph (1864-1938), French writer and professor medieval French language and literature, Collège de France; director *Revue de France* ('Les Légendes Épiques', presenting theory that epic poems are products of age when first written down, not oral heritage of earlier times; 'Lai de l'Ombre'; 'Tristan et Iseult').

Bedivere, Sir, a knight of the Round Table R-160

Bedlam, popular name of St. Mary of Bethlehem Hospital in London; founded 1247 as a priory; later became insane asylum, second such hospital in Europe; word came into general use for a lunatic asylum or a mad uproar.

Bedlington terrier D-82

Bedloe's, or Liberty, Island, in New York harbor, *map* N-130

Statue of Liberty L-101, B-52, N-22d, N-123, *pictures* L-101, N-124

Bed'ouins, wandering Arabs in deserts of Arabia and North Africa A-237, 238-9, *pictures* A-238, A-329, S-5

social organization F-10

Bedstraw, or cleavers, slender herbs comprising the genus *Galium* of the madder family with square stems, whorled leaves, and small flowers in flat-topped clusters; roots of several species yield a red dye; some species used in ancient times for bedding; flowers of yellow bedstraw (*Galium verum*) used in cheese making.

Bee, Barnard E. (1824-61), Confederate general, born Charleston, S. C.; served in Mexican War under Taylor and Scott; fatally wounded at Bull Run, making heroic stand with Gen. Thomas Jackson, to whom he gave the name "Stonewall."

Bee, an insect B-73-8, *color plates* B-76a, W-32a-b. *See also in Index* Beeswax; Honey

community life B-73-8
 drone B-76, *pictures* B-74, 75
 flight, language of, *diagram* B-78
 honeycomb B-73, 74, *pictures* B-75, B-76b
 inquilines, lazy bees B-78
 kinds
 bumblebee B-76, 77, *color plates* B-76a, W-32a-b
 carpenter B-77-8
 honey B-73-6, *pictures* B-76b: races B-76
 leaf-cutter B-78
 miner B-78
 social B-73-7
 solitary B-77-8, 73
 stingless B-77
 mandibles, *picture* I-82
 metamorphosis, *picture* I-87
 parasite, *picture* P-69
 pollen carriers I-88, B-73-4, 78, F-120: bumblebees B-76, 77, C-281
 queen B-74-6, *pictures* B-73, 74
 reproduction B-74, 76, *picture* B-75
 sting, *picture* I-86
 swarming B-76, *picture* B-76b
 wasps attack W-35
 wasps differentiated from, *color plate* W-32a-b
 winter care, *picture* B-76b
 worker B-73-4, *pictures* B-74, 75
Beebe (*bē'bē*), William (born 1877), American naturalist, explorer, and writer; honorary curator of birds and director of tropical research, New York Zoological Society; explored Nova Scotia, British Guiana, Borneo, Galapagos Islands, and other remote regions; writes of scientific facts in vivid and fascinating style ('Jungle Days'; 'Galapagos'; 'World's End'; 'The Arcturus Adventure'; 'Beneath Tropic Seas'; 'Half Mile Down')
 deep-sea exploration E-345, D-72, O-196, *picture* E-346
 eels' breeding place found by E-191
Bee-bread B-74, *picture* B-75
Beech, tree B-78-9, *pictures* T-133, 134
 Antarctic T-136
 blue or water beech. *See in Index* Hornbeam
 leaf, *picture* T-135
Beecham, Sir Thomas (born 1879), British musical conductor; founder of Beecham Symphony Orchestra and Beecham Opera Company; did much for promotion of grand opera and for modern orchestral composition.
Beecher, Henry Ward (1813-87), American preacher, born Litchfield, Conn., son of Lyman Beecher; as pastor of Plymouth Congregational Church, Brooklyn, N. Y., became famous throughout the world; warmed stern New England theology with conception of divine paternal love; champion of abolition and other unpopular causes
 brother of Harriet B. Stowe S-304
 woman suffrage interest W-132
Beecher, Lyman (1775-1863), American theologian, called "father of more brains than any other man in America"; born New Haven, Conn.; pastor in Litchfield, Conn., and Boston; president Lane Theological Seminary, Cincinnati
 father of Harriet B. Stowe S-304
Beech family, or Fagaceae (*fā-gā'sē-ē*), a family of plants, native to the northern hemisphere, including the oaks, beeches, chestnuts, giant chinquapin, and tanoak.
Beechnut B-79, *picture* B-78
Beef, flesh of cattle used for food
 cattle: breeds C-103, 104-5; care and feeding C-106
 cuts, *pictures* M-101

dried, or dehydrated D-39
 food value M-172
 "jerked" beef M-248
 packing-house process M-96, 97, *pictures* M-99-101
 "Beef-eaters." *See in Index* Yeoman of the Guard
Bee fly, fuzzy flies of the family *Bombyliidae*; larvae live as parasites in the nests of other insects: F-129
Beef tapeworm W-180a
Bee glue, or propolis B-75
Beehive coke oven C-298
Beehive huts, Zulus, *picture* S-200
Beehive State, popular name for Utah.
Beelzebub (*bē-ē'l'zē-būb*), or Baalzebub, in Old Testament, heathen god (II Kings I, 3, 6); in New Testament, prince of devils; in Milton's 'Paradise Lost', Satan's chief lieutenant: *picture* M-179
Bee-martin, or kingbird K-21, *color plate* B-137
Beer, Thomas (1889-1940), American writer, born Council Bluffs, Iowa; educated at Yale and Columbia Law School ('The Mauve Decade', study of American life at end of 19th century; 'Sandoval' and 'The Road to Heaven', novels; 'Stephen Crane', biography).
Beer A-112
 Bavarian production M-301-2
Beerbohm (*bēr'būm*), Sir Max (born 1872), English author and caricaturist, half brother of Herbert Beerbohm Tree; in his fiction, essays, parodies, and caricatures displays polished sophistication, detached observation, and irony ('Seven Men', 'Observations', and 'Rossetti and His Circle', caricatures; 'Zuleika Dobson', novel; 'A Christmas Garland', parodies).
Beer Hall Putsch, in Germany H-311
Beers, Clifford W. (1876-1943), American author and humanitarian, born New Haven, Conn.; lost his reason and after recovery wrote authentic account of the onset and cure of his disease ('A Mind That Found Itself'); founded Connecticut Society for Mental Hygiene, 1908, first of its kind in world.
Beersheba (*bē-ēr-shē'bā*), ancient village 50 mi. s.w. of Jerusalem; referred to in Bible as southern limit of Palestine: "Dan to Beersheba."
Beeswax B-76, W-58
 commercial uses B-76: electrotyping E-243
 manufactured by bees B-74, *picture* B-75
Beet B-79
 planting, *table* G-13
Beet, sugar, any kind of beet with high sugar content B-79, *picture* S-321
 breeding increases sugar P-245e, P-79
 industry S-319, 322
 producing regions
 Europe S-319: France F-174, S-319
 United States S-319-20: California C-28; Colorado C-310, 311, *picture* C-312; Michigan M-152, 153; Nebraska N-58; South Dakota S-217; Utah U-264, 266; Wyoming W-194
Beethoven (*bē'tō-vēn*), Ludwig van (1770-1827), German composer and musician B-79-80
 birthplace and museum B-174
 first great composer for piano P-210
 place in history of music M-313
Beetle-hunting wasp, a solitary wasp of the genus *Cerceris* W-34
Beetles B-80-5. *See also in Index* Weevils

antennae B-85
 armor (chitin) B-80, 82, I-84
 control S-262-3, P-326, J-228
 distinguished from other insects B-85
 eye B-85, *picture* E-351
 foot and claw, *pictures* I-84, F-147
 head, *picture* I-82
 killed by wasp W-34
 kinds
 Asiatic I-90
 bark F-156
 blister B-84, P-326, *picture* B-81
 bombardier B-82, *picture* B-84
 burying, *picture* I-83
 Calosoma, *picture* B-82
 carpet B-84
 click B-83
 "death watch" B-84, *picture* B-83
 diving B-84, *picture* B-81
 elephant B-82, *picture* B-81
 fireflies and glowworms F-58-9
 Hercules B-85, *picture* B-81
 Japanese I-90, *picture* I-93
 June bug J-228
 lady-bug, or lady-bird L-53, *picture* I-90
 Mexican bean I-90
 potato-bug P-326
 rove, or devil's coach-horse B-85, *picture* B-83
 scarab, sacred B-83
 stag B-85, *picture* I-82
 tiger B-82, *pictures* B-81, 84
 tumble-bug B-82-3
 water B-84-5
 whirligig B-85
 largest and smallest B-82
 mandibles, *picture* I-82
 name, origin B-82
 protective methods I-85
 sounds, how made, *picture* B-83
 wings B-80, 82
Beetleware, trade name for a kind of plastic ware made from urea resin; subjected to intense heat, is molded into tableware and utensils; light in weight, durable, non-inflammable; colors usually red, green, orange, yellow
 development of P-245k
Beetree, local name applied to the linden tree L-148
Beets (*bāts*), Nikolaas (1814-1903), Dutch writer; famous for his 'Camera Obscura', stories and sketches of peasant life showing humor and keen observation; wrote several volumes of poems ('Cornflowers', 'New Poems').
Beet sugar S-319, 322, B-79. *See also in Index* Beet, sugar
 manufacturing process S-322, *pictures* S-321
Begas (*bā'gās*), Reinhold (1831-1911), German sculptor of the naturalistic school; important works include monuments, portrait busts, genre, and mythological subjects.
Begbie, Sir Matthew Baillie (1819-94), Canadian frontier judge, born Edinburgh, Scotland; 1858 made judge of crown colony of British Columbia and maintained order there during the "gold rush"; chief justice of British Columbia 1870-94.
 'Beggars' Opera', a ballad opera by John Gay in which the characters were highwaymen, pickpockets, and thieves; a parody on the Italian operas of the day; first produced in London, 1728; many times revived.
 "Begging Brothers," Franciscans F-187. *See also in Index* Franciscans
Bégin (*bā-zhān'*), Louis Nazaire (1840-1925), Canadian cardinal, primate of Roman Catholic church in Canada, born Levis, Quebec; became archbishop of Quebec 1898; cardinal 1914.

Begon (*bū-jōn'*), Michel (1638-1710), French naval officer and patron of science

begonia named for B-85

Bego'nia family, or **Begoniaceae** (*bē-jō-ni-ā'sē-ē*), a family of plants and shrubs, native to the tropics, including the hillebrandia and the begonia B-85

Begum (*bā'gūm* or *bē'gūm*), title given to sultanas, princesses, or other Mohammedan women of high rank.

Be'gum of Oudh H-234

Behavior, animal A-202-3, P-361, 362, Outline Z-230. *See also in Index* Animals, subheads communication, community and social life, courtship, emotions, instinct and intelligence, learning, reflexes; Birds, subhead migration; Hibernation; Migration of animals

Behavior, human P-360-2, E-162-4, S-182-4, Outline P-363. *See also in Index* Character and personality; Character education; Child development; Child training; Habit character and personality C-140-1: traits, Outline C-142-3

conditioning R-64

development C-198-202

education modifies E-162-3, C-141-2

emotion E-262: children ruled by C-204a; development and control C-201, 203, 204

etiquette E-310-13

group activities S-183

habit H-193

heredity H-283-6

involuntary reaction W-98

learning L-79-82

Marcus Aurelius' teachings M-63

natural, in children C-204a

nerves N-64-5, *pictograph* N-64b

public places, manners E-311-12

reflex actions R-63-4, B-221, 223

voluntary actions W-98

will W-98-9

Behaviorism, in psychology P-362

Behemoth, animal, in Bible H-295

Behistun (*bā'hīs-tūn*) rock, *picture* P-135

Behn (*bēn*), Aphra (1640-89), the first professional English authoress; was a government spy for a time, then wrote plays and novels very popular in her time, but now little read because of their vulgarity. As a child she lived in Surinam where she met Oroonoko, the original of her novel by that name ('The Forc'd Marriage'; 'The Rover'; 'Sir Patient Fancy').

Behrens (*bā'rēnz*), Peter (born 1868), German architect, born Hamburg; pioneer of modern building; exponent of functionalism; noted chiefly for factories and apartment buildings starkly simple and finely proportioned.

Behring (*bā'ring*), Emil Adolf von (1854-1917), German physician; discovered diphtheria antitoxin; bovine vaccine to immunize cattle against tuberculosis; received Nobel prize in medicine (1901).

Behring, Vitus. *See in Index* Bering

Behrman (*bēr'mān*), Samuel N. (born 1893), American playwright, born Worcester, Mass.; light comedies ('Second Man'; 'Meteor'; 'Brief Moment'; 'Biography'; 'End of Summer'); moving-picture scripts ('Queen Christina'; 'Tale of Two Cities').

Beiderbecke, "Bix" (Leon Bismarck Beiderbecke) (1905-31), trumpet player, pianist, composer, born Davenport, Iowa; pioneer performer of swing and "hot" jazz; his im-

provings and amazing technical proficiency have become legendary ('In a Mist').

Beira (*bā'ē-rā*), seaport in Mozambique; important trade center and resort city; exports sugar, gold, cotton, and rubber; pop. 25,000: M-294, *maps* S-202, E-139

Beirut (*bā-rūt*), also Beyrouth, seaport and manufacturing city, cap. of republic of Lebanon, Syria; pop. 135,000; exports silk, tobacco, cotton: American University of Beirut (founded 1866): S-362, *maps* A-242, A-332b

Allenby captures W-164

Beisan. *See in Index* Bethshan

Beith, John Hay (Ian Hay) (born 1876), British novelist and dramatist; served in first World War: humor in war books won instant popularity ('Happy-Go-Lucky'; 'Carrying On'; 'The Poor Gentleman'; 'The Sport of Kings').

Bek-Budi (*bēk-by'di*), formerly Karshi, U.S.S.R., town in Uzbekistan about 100 mi. s.e. of Bokhara; pop. 25,000; meeting point of important roads; center of tobacco, fruit, and grain region; one of residences of Timur Leng (Tamerlane).

Békésaba (*bā-kāsh-chā'bā*), Hungary, market town, railroad junction, 123 mi. s.e. of Budapest; pop. 49,000; linen and hemp fabrics.

"Be Kind to Animals Week" H-354

Bel (*bēl*), one of the chief Babylonian gods; identified with the Phoenician Baal.

Bel, a measure of loudness. *See in Index* Decibel

Belasco, David (1854-1931), American dramatist and theatrical producer; born in San Francisco of Jewish family; presented E. H. Sothern, Mrs. Leslie Carter, Blanche Bates, David Warfield; noted for realistic settings and pioneer work in stage lighting; wrote or adapted many plays ('The Girl of the Golden West'; 'The Return of Peter Grimm').

Belch, Sir Toby, in Shakespeare's 'Twelfth Night', Countess Olivia's roistering disreputable uncle.

Belém (*bā-lēm*), Brazil, also Pará, seaport in n. on Pará River 55 mi. from Atlantic; pop. over 300,000: B-227, *maps* B-226, S-208b

rubber export R-166

Bel'fast, Ireland, cap. of Northern Ireland; pop. 440,000: B-85, I-129, *map* E-270a

Belfort (*bēl-fōr*), fortified town of e. France, important strategic position, in gap between Vosges Mountains and Jura Alps, near German and Swiss frontiers; pop. 46,000; taken by Germans in 1871 after 3-months' siege; restored to France 1919; again captured by Germany 1940: *map* F-179

'Lion of Belfort' by Bartholdi B-52

Belfort Gap, between Vosges and Jura mountains J-229

Belfry. *See in Index* Bell-tower

Belga (*bēl-gā*), monetary unit of Belgium, nominally worth about 14 cents, but variable in value.

Bel'gian Congo, or Congo State, Belgian colony in Africa C-331-2. *See also in Index* Congo State

Belgian draft horse H-343

Belgian duchess lace, *picture* L-49

Belgian hare H-223

Belgian sheep dog D-82

Belgium (*bēl-gi-ūm*), kingdom of w. Europe bordering North Sea, be-

tween Netherlands and France; 11,754 sq. mi.; pop. 8,000,000; cap. Brussels: B-86-90, *maps* B-87, E-326d, *Outline* N-74-5

agriculture B-86

army decorations D-32

art. *See in Index* Flemish art

books about N-75

business trusts, or cartels T-147

Christmas C-229a

cities B-87-8, *map* B-87: Antwerp

A-224-5, B-87, *picture* B-89;

Bruges B-252-4, B-87, *pictures*

B-88, B-253; Brussels B-254,

B-87-8; Ghent G-84, B-87; Liège

L-123; Ypres Y-209-10. *See also*

in Index names of cities

colonial possessions: Belgian Congo

C-331-2, *maps* A-42a

commerce

Antwerp A-224, S-38

exports and imports, *table* C-480

medieval B-86-7, 90

flag F-94, *color plate* F-88

government B-90

holidays: Independence Day H-322;

carnival, *picture* H-321

illiteracy P-304d

language B-90

manufactures B-88-90. *See also in*

Index names of Belgian cities

minerals B-88-90: glass sand G-106;

production and consumption, *pictograph* M-188a

national flower (Ghent azalea)

A-408

national song ('Brabançonne') N-25'

natural features B-86, 90

people B-86, 90

products B-86, 88

rivers B-87: Meuse M-131; Scheldt

S-38

Belgium, history of N-72-3, B-86-7,

B-90

Charles the Bold and the sacking of

Liège C-153, L-123

printing introduced P-347

Louis XIV claims L-201

France acquires N-7

Waterloo, battle of W-48

Independence gained N-73

Scheldt River controversy S-38

Congo acquired C-331-2

1st World War W-151-2, 154, A-2

German occupation B-90: Antwerp

A-224-5; Bruges B-254; Brussels

B-254; Liège L-123; Louvain

L-209; Ypres Y-210

Cardinal Mercier M-119

King Albert A-109

American relief work B-90, H-334

peace settlement W-173, C-332

debt to U. S. W-176-7

2d World War W-178b-i, B-90

Belgrade (*bēl-grād*), or Beograd,

cap. of Yugoslavia; pop. 242,000:

B-90-1, *maps* B-18, E-326d-e, *pic-*

ture Y-213

Belial (*bē'lī-āl*), Biblical name of Satan;

"sons of Belial," wicked or

worthless men.

Belin'da, heroine of Pope's 'Rape of

the Lock'. "If to her share some

female errors fall, Look on her

face, and you'll forgive them all."

Belinsky (*bēl-in'skē*), or Byelinsky,

Visarion Grigorevich (1810-48),

Russian critic and philosopher.

Belisarius (*bēl-i-sā'ri-ūs*) (505?-

565), Byzantine general to whom

Roman Empire under Justinian I

largely owed its safety against

Persians, Vandals, Ostrogoths,

Goths, and Bulgars; late legend

represents him blinded by Justin-

ian's jealousy, begging for alms in

Constantinople streets

Vandals conquered by V-272

Belize (*bā-lēz*), cap. of British Hon-

duras; pop. 17,000: H-330, *map*

C-132

Key—cāpe, āt, fār, fāst, whāt, fǫll; mē, yēt, fērn, thēre; īce, bīt; rōw, wōn, fōr, nōt, dō; cūre, būt, ryde, fūll, bārñ;

Belknap, William Worth (1829-90), U. S. secretary of war 1869-76; resigned after impeachment on charges of official corruption.

Bell, Alexander Graham (1847-1922), Scottish-American scientist and inventor B-93-4

cartoon, *picture* H-252
deaf-mute system introduced D-22
telephone invented B-93-4, T-34

Bell, Alexander Melville (1819-1905), Scottish-American educator, born Edinburgh; father of A. G. Bell; invented "visible speech," a method of phonetic notation for deaf-mutes: D-22

Bell, Sir Charles (1774-1842), Scottish anatomist; discovered distinction between motor, sensory, and sensori-motor nerves; called greatest contributor to physiology since Harvey.

Bell, Olive (born 1881), English art and literary critic; one of earliest exponents of "modernism" in art ('Art'; 'Since Cézanne'; 'Civilization'; 'Peace at Once').

Bell, Currer, Ellis, and Acton, pen names of Charlotte, Emily, and Anne Brontë. *See in Index* Brontë

Bell, Gertrude (1868-1926), English traveler and writer; authority on Orient, including archeology and modern politics; called "uncrowned queen of Mesopotamia"; aided British armies in Arabia during first World War through her knowledge of routes ('The Desert and the Sown'; 'Persian Pictures').

Bell, Henry (1767-1830), Scottish engineer, builder of steamship *Comet* (1812), first successful attempt in Europe to use steam in navigation; said to have inspired Fulton.

Bell, John (1797-1869), American statesman, born Nashville, Tenn.; appointed secretary of war in President Harrison's cabinet, later resigned; in U. S. Senate 1847-59; nominated for presidency 1860; supported Confederacy during Civil War: L-144

Bell, Robert (1841-1917), Canadian geologist, born Toronto, Ontario; professor of chemistry and natural sciences, Queen's University, Kingston; director Geological Survey; explored Baffin Land and Hudson Bay country, and surveyed large part of Canada.

Bell, Thomas, Scottish inventor I-74d
Bell, Calif., city, 5 mi. s.w. of Los Angeles; pop. 11,264; chiefly residential.

Bell B-91-3

Big Ben L-188. *See also in Index* Big Ben

chimes B-92; Bruges' bell-tower, *picture* B-253

church bells B-91

Czar-Kolokol at Moscow B-93, *pictures* B-93, M-264

Liberty Bell D-29, *picture* D-23

making and tuning B-92
market in Nijni-Novgorod, *picture* R-188

orchestra instrument M-323

ringing, method B-92, *picture* B-91
ship's time T-95-6

Bell, electric E-218

Bell, rescue, submarine, *picture* S-314

Bella Coola (bē'lā kō'lā), Salishan Indian tribe of British Columbia.

Belladonna, or deadly nightshade N-145, P-275, *picture* P-273

Bellaire, Ohio, city on Ohio River 4 mi. below Wheeling, W. Va.; pop. 13,799; in coal, iron, and clay region; glass and enamel wares; large river commerce: *map* O-210

Bel'amy, Edward (1850-98), American author and social reformer, born Chicopee Falls, Mass. ('Looking Backward', ideal picture of communistic commonwealth).

Bellanca (bē'lān'kā), Giuseppe M. (born 1886), Italian-American airplane builder, born Sciacca, Italy; manufactured first plane with propeller on front instead of rear; invented a number of aircraft safety devices; best known plane, *Columbia*, used by Chamberlin in New York-Berlin flight.

Bellarmino, Robert, Cardinal (1542-1621), Roman Catholic prelate, born Italy; became a Jesuit in 1560; taught theology at University of Louvain, Belgium 1570-76; made cardinal of Naples in 1598; preached and wrote against the heresies of the day and concerning the relation of church and state.

Bellay (bē'lē), Jean du (1492-1560), French cardinal, friend of Rabelais R-9

Bell-bird, name given to various tropical birds of the genus *Chasmorhynchus*, whose notes sound like tone of a bell; pure white with curious caruncle (fleshy appendage) hanging from forehead, some species having as many as three caruncles.

Belleau (bē-lō') Wood, France, battle in World War of 1914-18, near Château-Thierry B-94, W-172
American cemetery U-225

Belleek ware P-334

Bellefontaine, Ohio, city 50 mi. n.w. of Columbus in farming district; pop. 9808; railroad shops; funeral cars and busses, matches, metal furniture: *map* O-210

Belle Fourche (bēl fōrsh) Dam, S. D. S-217

Belle Isle (bēl il), Detroit, Mich., *picture* D-57

Belle Isle, Strait of, channel between Labrador and Newfoundland, n. entrance to Gulf of St. Lawrence from Atlantic; 10 to 15 mi. wide; named from granite island at Atlantic end: C-69, *map* C-50c
Cartier at S-8

Bellerophon (bē-lēr'ō-fōn), Greek mythical hero, rider of Pegasus P-100

Belleville, Ill., city 14 mi. s.e. of St. Louis, Mo., in coal-mining region; pop. 28,405; stoves, shoes, machinery; Scott Field, U. S. Army aviation base.

Belleville, N. J., residential suburb of Newark, on Passaic River; pop. 28,167.

Belleville, Ontario, port on Bay of Quinté and Moira River about 100 mi. e. of Toronto; pop. 13,790. cement works, saw and planing mills, foundries; ships grain, lumber, and dairy products; Albert College.

Bellevue, Pa., residential borough 7 mi. n.w. of Pittsburgh; pop. 10,488.

Bellflower, common name of a genus (*Campanula*), chiefly of perennial plants, which includes the bluebell, Canterbury bells, and harebell: B-159
how to plant G-10

Bellflower family, or Campanulaceae (kām-pān-ū-lā'sē-ē), a family of plants, shrubs, and trees, including balloon flower, Venus looking-glass, bluebell, shepherds-scabious, and giant bellflower.

Belligerent, in international law I-109

Bellingham, Wash., shipping center 75 mi. n. of Seattle on Bellingham

Bay; gateway to Mt. Baker National Forest; pop. 29,314; salmon-fishing center of the Pacific; lumbering and dairying interests; canned salmon and fruit, lumber products, coal, cement, beet sugar; state teachers college: *map* W-29

Bellingrath Gardens, at Mobile, Ala. M-212

Bellingshausen (bē'līngz-hou-zēn), Fabian Gottlieb von (1778-1852), Russian Antarctic explorer and naval officer A-217

Bellini (bēl-lē'nē), Giovanni (1430?-1516) and Gentile (1429-1507), Venetian painters. Giovanni was first great Venetian colorist and most important figure of early Venetian school: P-16, T-98

Bellini, Jacopo (1400?-1470 or 71), painter, born in Venice; father of Gentile and Giovanni Bellini; important in the development of Venetian art; only a few paintings, largely Madonnas, and two remarkable books of drawings are extant.

Bellini, Vincenzo (1801-35), Italian operatic composer ('Sonnambula'; 'Norma'; 'I Puritani').

Bellis, a genus of low herbs of the composite family; includes the true daisy, *Bellis perennis*, a popular garden flower, often called English daisy: D-5
how to plant G-10

Bellman, Carl Michael (1740-95), Swedish lyric poet; poems and songs, gay and patriotic in spirit, celebrating the joy of life; ballads popular among Swedes.

Bell metal C-176b, A-132, B-92

Bello (bel'yō), Andrés (1781-1865), Chilean educator and poet L-67i, u, *picture* L-67t

Belloe (bē'lōk), Hilaire (born 1870), English author, born France; prolific writer of essays, biography, history, fiction, satire, and poetry, including humorous and nonsense verse; an ardent Roman Catholic ('The Path to Rome'; 'Danton'; 'Richelieu'; 'Wolsey'; 'On Nothing'; 'The Bad Child's Book of Beasts'; 'The Man Who Made Gold') essays E-289

Bello Horizonte (bāl'ō-rē-zōn'tā), city in Brazil, cap. state of Minas Geraes; mining, agriculture, diamond cutting; pop. about 180,000; 375 mi. n.w. Rio de Janeiro: *map* B-226

Bellona (bē-lō'nā), in Roman mythology, goddess of war, described as wife or sister of Mars.

Bellonte, Maurice, French aviator, *picture* A-73

Bellows, George W. (1882-1925), American painter; work characterized by boldness and breadth in execution; often satirical in spirit ('Up the Hudson'; 'Forty-two Kids'; 'Skating').

Bellows, in organ O-248, 250, *picture* O-249

Bell Rock, or Incheape Rock, dangerous reef in North Sea opposite Firth of Tay, Scotland; Southey's ballad 'The Incheape Rock' repeats legend of pirate who removed from rock bell placed on it by Abbot of Aberbrothok, later being wrecked there; lighthouse designed by Robert Stevenson erected in 1810.

Bell-Smith, Frederick Marlett (1846-1923), Canadian painter, born London, England; most celebrated for landscapes, although figure and portrait work holds high rank ('Lights of a City Street'; 'Queen Victoria's Tribute to Canada').

Bell telephone system T-37
 Bell-tower, a belfry or campanile B-91
 Belgium B-37; Bruges, *picture* B-253; Brussels B-254
 Giotto's Tower I-167, G-89, *pictures* G-90, F-108
 Giralda, Seville S-86
 Hungary, *picture* H-360
 Leaning Tower of Pisa P-222, I-164, *picture* P-223
 Louisiana State University, *picture* L-205
 Mint Tower, Amsterdam, *picture* A-189
 Moscow, *picture* M-264
 Mountain Lake, Fla., *picture* F-115
 Parliament Building, London L-188, *picture* L-183
 St. Mark's V-278
 St. Michel, Bordeaux B-194
 Springfield, Mass. S-264
 Bellwort, fleshy-rooted herbs comprising the genus *Uvularia* of the lily family with drooping yellowish bell-shaped flowers and stems that appear to run through the leaves (perfoliate).
 Belly River, in Alberta, unites with Bow River to form South Saskatchewan.
 Belmont, August (1816-90), American financier, born Alzey, Germany; came to New York as representative of Rothschilds, bankers; acted as consul general for Austria; U. S. minister to the Netherlands; chairman Democratic National Committee; father of Perry Belmont (born 1851), U. S. minister to Spain (1888-89), and August Belmont (1853-1924), financier and democratic leader.
 Belmont, Mass., town 7 mi. n.w. of Boston; its market gardens furnish early vegetables for that city; pop. 26,867.
 Beloit, Wis., city on Rock River near Illinois border in rich agricultural region; pop. 25,365; scales, wood-working and paper-mill machinery, engines: W-126, *map* W-124
 Beloit College, at Beloit, Wis.; chartered 1846 (opened 1847); classics, philosophy, science, art.
 Bel Paese (*pî'zè*), an Italian cheese, semi-hard and of rubbery texture; flavor between Cheddar and Limburger.
 Belshazzar (*bêl-shâz'âr*), in the Book of Daniel, last king of Babylon, son and successor of Nebuchadnezzar; warned of his doom by "hand-writing on the wall," interpreted by Daniel: B-8
 temple, *picture* A-258
 Belted kingfisher K-21
 Belterra, rubber plantation in Brazil B-227
 Belt generator, a machine for building up high electric charges; the charge is collected by brushes in contact with a rapidly moving belt and accumulated in a large metal globe; invented by R. J. Van de Graaff in 1933 and used for atom smashing: A-362
 Belting, rubber manufacture R-168
 Belt of calms, or doldrums W-112, *picture* W-113
 daily thundershowers R-46
 Beltrami (*bêl-trâ'mê*), Giacomo Constantino (1779-1855), Italian explorer; exiled from Italy 1821 came to U. S.: M-194
 Beluga. See in Index White whale
 Belvedere (*bêl-vî-dêr*), Italian *bêl-vâ dâ'râ*, a gallery in the Vatican Rome, which contains fine art

treasures including the 'Apollo Belvedere' and the 'Laocoön'.
 Bely, Andrey. See in Index Byely
 Bemberg rayon R-55
 Bemelmans, Ludwig (born 1898), Austrian-American artist and author of books for adults and children, born in the Tyrol; 'Hansi', reminiscent of his childhood and illustrated with lithographs of rugged simplicity.
 Bemidji (*bê-mîj'i*), Minn., city and summer resort on Bemidji Lake, 140 mi. n.w. of Duluth; pop. 9427; lumber, dairy products, brick, woollens; fur-farming in vicinity; state teachers college: *map* M-192
 Bemis Heights, battles of. See in Index Freeman's Farm, battles of
 Benaco (*bâ-nâ'kô*), Lake, also Garda, largest lake of n. Italy, extending from Lombard plain into Tyrolean Alps: *map* I-156
 Ben-Ami, Jacob (born 1890), Jewish actor born Minsk, Russia; came to U. S. soon after first World War to play in Yiddish Art Theater.
 Benares (*bê-nâ'rês*), India, city in n.e., on Ganges River; pop. 200,000: B-94-6, G-5, *maps* I-30, A-332c
 Benavente y Martinez (*bâ-nâ-vên'tâ ê mâr-tên'âh*), Jacinto (born 1866), Spanish dramatist; influential in freeing modern Spanish stage from artificiality and melodrama; awarded Nobel prize in literature 1922 ('The Passion Flower'; 'The Bonds of Interest'; 'Smile of Mona Lisa'): S-237, *picture* S-237
 Benbecula, island of Hebrides H-267
 'Ben Bolt', the name of a song by Thomas Dunn English (1819-1902), beginning: "Don't you remember sweet Alice, Ben Bolt?"; first published about 1840.
 Benchley, Robert C. (born 1889), American humorist and critic, born Worcester, Mass.; managing editor *Vanity Fair* 1919-20; drama critic *Life* 1920-29, and *New Yorker* after 1929; wrote and acted for motion pictures and radio ('Of All Things'; 'Love Conquers All'; 'My Ten Years in a Quandary').
 Bench mining. See in Index Open-pit mining
 Bend, Ore., city in cent. part of state, on Deschutes River; pop. 10,021; important lumbering and agricultural center: *map* O-246
 Bend, in heraldry H-281
 Benda, Wladyslaw Theodor (born 1873), American artist, born Poznan, Poland; best known for illustrations and for fantastic masks used in stage productions.
 Ben Day process, in photoengraving E-298
 Bender Eregli. See in Index Eregli
 Bendigo (*bên'dî-gô*), Australia, city in Victoria 90 mi. n.w. of Melbourne; pop. 30,000; formerly large gold field: *map* A-372a
 Bendix starter, automobile A-406
 "Bends, the," or caisson disease H-271
 Ben'edick, in Shakespeare's 'Much Ado About Nothing', a wit and avowed bachelor who, caught by the same trick that snares Beatrice, falls in love with her, becoming "Benedick, the married man."
 Benedict, of Nursia, Saint (480?-544?), Italian monk, founder of the Benedictine Order; festival March 21: M-233, B-178-9
 Benedict, popes. For list see in Index Pope
 Benedict I (died 579), pope B-96

Benedict V (died 965), pope B-96
 Benedict XIII (1649-1730), pope B-96
 Benedict XIII (Pedro de Luna) (1328-1424), anti-pope B-96
 Benedict XIV (1675-1758), pope B-96
 Benedict XV (1854-1922), pope B-96
 Benedictines, a monastic order sometimes called "Black Monks" B-96, M-233, *picture* M-232
 preserve classics B-179
 Westminster Abbey W-73
 Beneficiary insurance I-95
 will W-98
 Beneficium, a form of landholding in feudal times F-28
 Benefit of clergy, phrase referring to privilege claimed by medieval clergy of being tried in bishop's instead of king's court under secular jurisdiction; finally abolished in England 1827
 Becket defends B-72
 Benefits, in labor unions L-44b, o
 Beneke (*bâ'nê-kê*), Friedrich E. (1798-1854), German psychologist and professor of philosophy; opposed Hegelian speculation; taught empirical, genetic psychology.
 Benelli (*bâ-nêl'lô*), Sem (born 1877), Italian playwright, particularly successful with historical dramas in blank verse ('The Jest'; 'The Love Thief'; 'The Whim'; 'The Love of Three Kings', used for opera).
 Benes (*bên'ash*), Eduard (born 1884), president of Czechoslovakia 1935-38; foreign minister 1918-35; with Masaryk organized independence movement; one of founders of Little Entente; member of Council of League of Nations; came to United States and was appointed to faculty of University of Chicago 1939; president of Czechoslovakian government in exile after July 1941 ('Spirit of the Czechoslovak Revolution'; 'Problem of Slavonic Policy'): C-421
 Benét, Laura (born 1894), poet and author of children's books; sister of Stephen and William, born Fort Hamilton, N. Y. ('Basket for a Fair', poetry; 'Boy Shelley', a tribute to poetry; 'Hidden Valley', story about Yosemite; 'Enchanting Jenny Lind', a biography).
 Benét (*bên-nâ'*), Stephen Vincent (1898-1943), American poet and novelist, born Bethlehem, Pa., brother of William Rose Benét; early poems attracted attention for their exuberance and fancy ('Five Men and Pompey'; 'Young Adventure'); won Pulitzer prize 1929 with 'John Brown's Body', stirring narrative poem giving panorama of Civil War period: *picture* A-183
 Kipling characterized by K-24
 Benét, William Rose (born 1886), poet, novelist, and critic; born Fort Hamilton, N. Y.; married Elinor Wylie 1923, and Marjorie Flack 1941; verse rich in imagination, vigorous rhythms ('The Falconer of God'; 'Man Possessed'; 'The First Person Singular', novel). Won Pulitzer prize 1942 with 'The Dust Which Is God', novel in verse.
 Benevento (*bâ-nâ-vên'tô*) (ancient Beneventum), Italy, town 32 mi. n.e. of Naples; pop. 34,000; arch of Trajan
 battle of (1266) F-107
 Beneven'tum, battle of (275 B.C.) Romans defeat Pyrrhus P-374
 Bengal (*bên-gâl'*), province and native states in n.e. India; nearly 83,000

Key—câpe, ât, fâr, fâst, whqt, fâll; mē, yēt, fērn, thêre; ice, bit; rôw, wôn, fôr, nôt, dō; cûre, bût, rûde, fûll, bârn;

- sq. mi.; pop. over 50,000,000: B-96, map I-31
Calcutta (cap.) C-20-1
Clive C-272
Hastings H-234
silk culture S-145
- Bengal**, Bay of, portion of Indian Ocean between India and Burma I-51, B-278a, maps I-30, A-332a, c
Bengal fire C-176b
- Bengali** (*bēn-gū'lē*), modern dialect of India, akin to Uriya, Assamese, Bihari, and Hindustani; word of English origin, derived from *Bengal* in which province it is spoken; makes free use of Sanskrit words; literature known in Western world through works of Tagore.
- Ben-galine**, a silk fabric similar to poplin but heavier.
- Bengal saltpeter** C-176b
- Bengal tiger** T-92-3, picture T-93
- Bengasi**, or **Benghazi** (*bēn-gū'zī*), seaport and province in Libya; city founded by Greeks of Cyrenaica as Hesperides; renamed Berenice by Ptolemy III; pop. of city 50,000: L-121b, map A-42a
rainfall L-121a
- Bengough** (*bēn-gōf*'), John Wilson (1851-1923), Canadian cartoonist and poet, born Toronto; founded humorous weekly *Grip*; later cartoonist with *Montreal Star* and *Toronto Globe*.
- 'Ben Hur, a Tale of the Christ'**, a vivid story by Lew Wallace (1880). The hero, a noble young Jew, innocently condemned to the galleys by the Romans, has many adventures, and eventually becomes a Christian.
- Beni-Hassan** (*bā'nē-hā'sūn*), village, Upper Egypt; rock tombs and paintings (about 3000 B.C.).
- Benitoite** (*bē-nē'tō-it*), a transparent blue or colorless mineral (BaTiSi₃O₉) used as a gem; found only in California.
- Benjamin**, youngest son of Jacob and Rachel, and ancestor of the tribe of Benjamin (Gen. xxxv, 18).
- Benjamin, Judah P.** (1811-84), American lawyer, born Saint Croix, West Indies; Confederate politician, attorney general and secretary of war 1861, secretary of state 1862-65.
- Benjamin bush**. See in *Index* Spice bush
- Ben Lo'mond**, mountain (3192 ft.) in Stirlingshire, Scotland, on shore of Loch Lomond.
- Ben Macdhu** (*māk-dū'ē*), second highest mountain (4296 ft.) in Great Britain; in Grampian range in Banff and Aberdeen counties, Scotland.
- Bennet, Henry, Earl of Arlington**. See in *Index* Arlington, Henry Bennet, Earl of
- Bennett, Arnold (Enoch)** (1867-1931), English novelist and playwright, born in Staffordshire, England's pottery district; trained for law; editor of *Woman*, weekly paper, 1896-1900; master at portraying middle-class English life (novels: 'The Old Wives' Tale'; 'Clayhang-er'; 'The Card'; 'Riceyman Steps'; plays: 'Milestones'; 'The Great Adventure'): N-183, E-288, picture E-288
'Five Towns' E-278
- Bennett, Charles H.** (1830-67), English illustrator, wood engraver; illustrated children's books, also 'Pilgrim's Progress', and made drawings for *Punch*
drawings for 'Pilgrim's Progress' B-274, 275
- Bennett, Floyd** (1890-1923), American aviator, born Warrensburg, N. Y.; in aviation corps, U. S. Navy; pilot of plane in which Byrd flew across North Pole 1926; awarded Congressional Medal of Honor; developed pneumonia in flight to aid German-Irish transatlantic flyers, and was stranded near Quebec, Canada, where he died.
- Bennett, Henry Holcomb** (1863-1912), American writer
'The Flag Goes By', quoted F-84
- Bennett, James Gordon** (1795-1872), American journalist, born Scotland; originated detailed reporting of public events, practise of interviewing, use of telegraph in reporting, and system of distribution by carriers, making the *New York Herald*, started 1835, one of the most valuable newspaper properties
balloon race, picture B-26
newspaper innovations N-106-7
- Bennett, James Gordon, Jr.** (1841-1918), editor and proprietor *New York Herald*, born New York City
sends Stanley to Africa S-270
- Bennett, John** (born 1865), American writer, born Chillicothe, Ohio; contributor of articles on Negro dialect and folk-lore to magazines; wrote stories of Elizabethan period and other tales for children ('Master Skylark'; 'The Story of Barnaby Lee').
- Bennett, Richard** (born 1899), Irish-American artist and author of books for children ('Skookum and Sandy', outdoor life in Pacific Northwest; 'Shawneen and the Gander' and 'Hannah Marie', Irish in scene and humor).
- Bennett, Richard Bedford, Viscount** (born 1870), Canadian statesman, born near Hopewell, New Brunswick; several years in Canadian House of Commons; served as minister of justice and attorney general and as minister of finance; as leader of Conservative party was prime minister of Canada 1930-35.
- Bennett, Sir William Sterndale** (1816-75), English pianist and composer; greatly influenced by Mendelssohn; produced work of grace and charm ('Woman of Samaria', cantata; 'Paradise and the Peri', overture).
- Bennett, Luke**, Yukon, Canada Y-214
- Bennett College**, at Greensboro, N. C.; founded 1926 by Methodist Episcopal church; for women; arts and sciences.
- Ben Ne'vis**, peak in western Scotland; highest point in British Isles (4406 ft.): map E-279, picture S-45
- Bennington, Vt.**, village 30 mi. n.e. of Troy, N.Y.; pop. 7628; apples, knit goods, paper products; Bennington College: map N-86
- Bennington, battle of** V-288
celebrated H-321
- Bennington College**, at Bennington, Vt.; first 4-year progressive college for women; opened 1932; art, literature, social studies, science; non-resident work.
- Bennington flag**, carried at battle of Bennington (1777) F-98, color plate F-90
- Benozzo Gozzoli**. See in *Index* Gozzoli, Benozzo
- Benson, Arthur C.** (1862-1925), English essayist and literary critic, meditative, refined, scholarly ('The Upton Letters'; 'From a College Window'; 'Beside Still Waters'), quoted on conversation C-347b
- Benson, Edward Frederic** (1847-1940), English author; in youth with British Archeological School in Athens; first attained fame with society novel 'Dodo' (1893); also wrote 'Vintage'; 'The Capsina'; 'David Blaize'; 'Mezzanine'; 'Pharisees and Publicans'; 'Spook Stories'; 'As We Were'; 'Queen Victoria'.
- Benson, Edward White** (1829-96), English churchman, archbishop of Canterbury; father of Arthur C., Edward F., Robert Hugh.
- Benson, Frank Weston** (born 1862), American painter and etcher; portraits of women and children in bright outdoor settings; etchings of wild ducks.
- Benson, Robert Hugh** (1871-1914), Roman Catholic priest; wrote much on religious subjects and several novels ('The Light Invisible'; 'Christ in the Church'; 'Come Rack! Come Rope!'; 'An Average Man').
- Benson, Stella** (1892-1933), witty, brilliant English novelist, poet; daughter of English squire; worked in London slums; worked way around world as maid, "chore boy," book agent; married J. G. O'Gorman Anderson and went to live in Manchuria ('Living Alone'; 'The Poor Man'; 'Good-bye, Stranger'; 'The Far-away Bride'; 'Hope against Hope', short stories).
- Benson, William Shepherd** (1855-1932), admiral, United States Navy; graduated U.S. Naval Academy; chief of naval operations 1915-19; served on commissions abroad during World War of 1914-18 and American Commission to Negotiate Peace 1918-19; retired 1919: on U.S. Shipping Board 1920-28.
- Bentgrass**, common name for a genus (*Agrostis*) of grasses, usually perennial. Although seeds are produced, these plants generally multiply by means of stolons (creeping stems that take root on, or just below, surface of the ground). Used for forage and lawns; important species: redtop (*A. alba*), colonial bent (*A. tenuis*), creeping bent (*A. palustris*), velvet bent (*A. canina*).
- Ben'tham, Jeremy** (1748-1832), English philosopher and jurist; shocked by legal abuses, he surveyed existing institutions to see whether they served the "greatest good of the greatest number," thus founding Utilitarian School: P-172
- Ben'thos**, form of marine life O-200
- Bentley, Wilson Alwyn** (1865-1931), meteorologist, born in Jericho, Vt.; photographed snow crystals: S-174
- Benton, Thomas Hart** (1782-1858), U.S. senator E-96-7
quoted on Zachary Taylor T-20-1
- Benton, Thomas Hart** (born 1889), painter, born Neosho, Mo.; named for his great-uncle (see above); studied art in Paris, but found his subject matter in common American life; skilled draftsman, vigorous and often cartoon-like in his emphasis; famous for murals in Whitney Museum and New School for Social Research in New York City, and in Missouri state capitol; autobiography, 'An Artist in America'.

ü=French u, German ü; gem, jo; thin, then; ù=French nasal (Jean); zh=French j (z in azure); κ=German guttural ch

Benton Harbor, Mich., one of the world's largest peach markets; across Lake Michigan from Chicago; pop. 16,668; ships quantities of other fruit; various manufactures: *map M-153*

Bentonite, claylike mineral of volcanic origin capable of absorbing enormous quantities of water; when soaked in water serves purpose of soap; used as filter for oil and as filler, binder, or plastic in manufacture of great variety of articles: first found in commercial quantities around Fort Benton, Wyo.: *C-261*

Benue (*bā'ug-ā*), chief e. tributary of the Niger, w. Africa, 870 mi. long; large part navigable: *map A-42a*

Benwood, W. Va., iron and steel manufacturing town on Ohio River, just below Wheeling; pop. 3608.

Benz, Karl (1844-1929), German engineer and inventor, born Karlsruhe, Germany; made his first automobile in 1885.

Benzene, a compound of carbon and hydrogen (C_6H_6), often called benzol *B-97, C-176a*. See also Benzine in Buna S rubber, *diagram R-169b* products made from *C-288-9, C-81*

Benzene ring, *diagram C-176a*

Benzine, a mixture of paraffin hydrocarbons distilled from petroleum *B-97, P-149*. See also in *Index Benzene*

Benzoate of soda, a salt of benzoic acid and sodium antiseptic and food preservative *A-223*

Benzoic acid, an organic acid ($C_6H_5O_2$) formed from benzene and crystalline at ordinary temperatures; used in dye making and medicine; obtained synthetically from toluol or the gum, benzoin.

Benzoin (*bēn'zō-in*), a resinous substance obtained from the stem of various species of *Styrax*, especially *Styrax benzoin*, a tree of south Asia; used in medicine, as an incense, and in perfume.

Benzol. See in *Index Benzene*

Beograd (*bā'ō-grūd*). See in *Index Belgrade*

Beowulf (*bā'ō-wulf*), hero of early Anglo-Saxon epic poem which bears his name *B-97, S-303f*

Béranger (*bā-rāh-zhā'*), Pierre Jean de (1780-1857), French song writer, poet of the people, and political satirist.

Berbera, principal city, port, and capital of British Somaliland, n.e. Africa; permanent pop. about 15,000, increased by caravans to 30,000: *map A-42a*

Berberidaceae (*bēr-bēr-i-dā'sē-ē*). See in *Index Barberry family*

Berberis, name of the barberry genus of shrubs *H-270*

Berbers (*bēr'bērs*), ancient white race of n. Africa; includes Kabyles, Rifians, and Tuaregs; gave name to Barbary States: *M-255*

Algeria *A-125, 126*

Libya *L-121b*

Morocco *M-260*

Sahara (Tuaregs) *S-6*

Tunisia *T-151*

Berceuse (*bēr-sūz'*), in music, a cradle song or lullaby; vocal or instrumental composition, melodious, with a quiet, rhythmic swing.

Berchtesgaden, Germany, town in Bavarian Alps, about 13 mi. s. of Salzburg; pop. about 4000; winter resort center noted for fine climate

and scenic beauty. Town founded by Augustinian monks in 1108 contains fine old castle and abbey church. Near by is "Berghof," the country home of Adolf Hitler; designed by him and used as a "mountain retreat."

Bereovici (*bēr-kō-vē'chō*), Konrad (born 1882), American-Rumanian author; earlier years devoted to music and teaching, later years to travel and writing; spent much time among the gipsies ('Ghitza and Other Romances of Gypsy Blood'; 'Against the Sky'; 'Nights Abroad'; 'And This Is Only the Beginning').

Berezy, William von Moll (1748-1813), Canadian colonizer and artist, born Saxony, Germany; failed in attempts to settle German colonists in New York State in 1792, and in Upper Canada in 1794; made living by painting and is one of the earliest of Canadian artists.

Berdichev (*bēr-dēch'ēf*), Ukraine, market town 100 mi. s.w. of Kiev; pop. 66,000; famous fairs; scene of many conflicts between Poles and Russians.

Bere'a, Ky., town 95 mi. s.e. of Louisville, where Cumberland foothills meet the Bluegrass region; pop. 2176; seat of Berea College: *map K-11*

Berea College, at Berea, Ky.; founded 1855; elementary, industrial, secondary, normal, and collegiate departments; music, home economics, agriculture, industrial arts, business.

Berenguer (*bēr-ēn-gēr*) y Fusté, Damaso (born 1873), Spanish general and statesman, dictator 1930.

Berenice (*bēr-ē-nī'sē*), wife of Ptolemy III, Euergetes. It is said that her hair, which had been pledged to the gods for her husband's safe return from Syria, was carried to heaven from the Temple of Venus and became the constellation *Coma Berenices* ("Berenice's hair") constellation, *charts S-275c, g, h*

Berenice, Libya. See in *Index Bengasi*

Ber'esford, Charles William, first Baron (1846-1919), English admiral, member of Parliament, and author; leader of "big navy" party.

Beresford, John Davys (born 1873), English author; abandoned architecture for literature; novels display keen psychological insight ('Jacob Stahl'; 'The Mountains of the Moon'; 'These Lynnekers').

Berg, Alban (1865-1935), Austrian composer; extreme modernist ('Wozzeck', 'Lulu', operas).

Bergamo (*bēr-gā-mō*), Italy, picturesque town 30 mi. n.e. of Milan; pop. 83,000; notable old churches; silk and other textiles.

Ber'gamot, a kind of mint *M-195*

Bergamot orange *O-240*

Bergen, Belgium. See in *Index Mons*

Bergen (*bēr-g'ūn*), Norway, chief port on s.w. coast; pop. 100,000; exports fish and fish products; shipbuilding: *N-174, map N-173* fish market, *picture N-177*

Bergenfield, N. J., borough across Hudson River from New York City; pop. 10,275.

Bergen-op-Zoom (*bēr-kēn-ōp-zōm*), Holland, old town on Zoom 20 mi. n. of Antwerp; pop. 21,000; famous as scene of many sieges.

Berger, Victor L. (1860-1929), Amer-

ican Socialist politician, born Nieder Rehbach, Austria-Hungary; edited Socialist journals, Milwaukee; first Socialist ever elected to Congress (1910); because of pacifist preaching during World War of 1914-18 excluded from Congress and sentenced to 20 years imprisonment; decision was reversed by Supreme Court and he was finally seated 1923; wrote pamphlets on social questions.

Bergerac (*bēr-zhū-rāk'*), Cyrano de (1619-55), French novelist, dramatist, and daring duelist; subject of Rostand's drama 'Cyrano de Bergerac'.

Bergh (*bērg*), Henry (1820-88), American philanthropist and author, born New York City *H-354*

Bergius (*bēr-gē-us*), Friedrich (born 1884), German chemist; developed processes for converting coal into gasoline and oil, and wood into coal by use of high-temperature, high-pressure methods using hydrogen atmosphere; made edible sugar from wood; awarded Nobel prize in chemistry 1931 with Dr. Karl Bosch: *P-149*

Bergson (*bērg-sōn'*), Henri (1859-1941), French philosopher, of Jewish parentage; denied claim of science to explain universe on mechanical principles; regarded life not as something static, but a matter of time and change, unending creation (creative evolution); awarded Nobel prize in literature 1927 ('Time and Free Will'; 'Matter and Memory'; 'Creative Evolution'; 'Laughter'): *F-198*

Bergström (*bērg'strām*), Hjalmar (born 1868), Danish dramatist, a director of the Danish Dramatic Society ('The Golden Fleece'; 'In the Swim'; 'The Way to God').

Beriberi (*bēr'i-bēr'i*), nervous disease resulting in paralysis, dropsy, and frequently death; caused by vitamin deficiency: *V-311, 311b, 312*

Bering (*bē'ring*), or Behring, Vitus (1680-1741), Danish navigator, commissioned by Peter the Great to explore n.e. Asiatic coasts for Russia: *B-97, A-103*

Bering Sea, arm of North Pacific Ocean between Alaska and Siberia *B-97, maps N-150b, A-105*. See also in *Index Ocean, table* aviation route *A-106-7* seal fisheries arbitration *S-70, H-230* seals *S-69-70, A-102*

Bering Strait, channel separating Asia and North America and connecting North Pacific with Arctic Ocean *B-97, maps N-150b, A-105* route of Asiatic migration *N-150*

Bériot (*bā-rē-ō'*), Charles Auguste de (1802-70), Belgian violinist and composer; married singer Mme. Malibran; many compositions and a 'Method' for violin students. His son, Charles Vilfride de Bériot (1833-1914), a noted pianist.

Berkeley (*bärk'li*), George (1685-1753), English idealistic philosopher who maintained that matter has no existence independent of mind; political economist, writer, and Anglican bishop ('Essay Towards a New Theory of Vision'; 'Treatise Concerning the Principles of Human Knowledge').

Berkeley, John, Baron of Stratton (died 1678), grantee of New Jersey *N-92*

Key—cāpe, āt, fār, fāst, whāt. fāll; mē, yēt, fērn, thēre; īce, bīt; rōw, wōn, fōr, nōt, dō; cūre, būt, rŭde, fŭll, bōrn;

Berkeley, Sir William (1608-77), tyrannical and extortionate English governor of Virginia V-307
quoted on education E-176
suppresses Bacon's Rebellion B-11

Berkeley (*bérk'li*), Calif., residential and manufacturing city on e. shore of San Francisco Bay, opposite Golden Gate; pop. 85,547; steel, ink, chemicals, packed fruits, wood products; state university: map C-28
Museum of Paleontology, table M-393
stadium, picture C-29

Berkeley Springs, W. Va., pop. 1145
W-74, map W-76

Berkman, Alexander (1870-1936), anarchist, born in Poland; he was a printer by trade; he and Emma Goldman published *Mother Earth*, anarchist monthly; was deported from United States to Russia, 1919.

Berkshire, agricultural county in s. England, s. of Thames River; 710 sq. mi.; pop. 214,000; county seat Reading.

Berkshire Hills, Mass. M-84, map M-82

Berkshire hog H-316, picture H-315

Berlage (*bér'lá-ké*), Hendrik Petrus (1856-1934), Dutch architect; departed from the classical styles and with brick as favorite material developed a simple, austere form which is now the characteristic architecture of modern Holland; architectural adviser to Amsterdam, The Hague, and Rotterdam.

Berlichingen (*bér'lik-ing-én*), Götz von (1480-1562), "Götz with the iron hand," German feudal knight and adventurer; subject of drama by Goethe.

Berlin, Irving (originally Israel Baline) (born 1888), American popular song writer, born Russia; brought to U. S. 1893; won reputation with 'Remember', 'Always', 'Alexander's Ragtime Band', and other syncopated compositions.

Berlin (*bér-lín*), cap. and largest city of Germany; pop. 4,335,000: B-98-99b, map G-66, pictures B-98-99b, G-75
air raids W-179c-d
art galleries and science museums, table M-392, 393

Berlin, N. H., on Androscoggin River surrounded by rugged mountains; pop. 19,084; abundant water power for manufactures; paper, pulp, lumber: map N-86

Berlin, Congress of (1878), meeting of representatives of Great Britain, Germany, France, Austria, Russia, and Turkey to revise Treaty of San Stefano: T-163-4

Bulgaria B-270
Disraeli at D-71

Berlin, University of B-99a

Berlin Conference (1884) A-42

Berlin Decree (1806), order issued by Napoleon providing that all ports under his control be closed to British goods N-10, W-8

Berliner (*bér'lin-ér*), Émile (1851-1929), German-American inventor, born Hanover, Germany; had only grammar school education; followed mercantile career until 1878; inventions include telephone transmitter, disk talking machine, and radio microphone; founded Bureau of Health Education.

Berlin to Baghdad Railway A-336, B-14

Berlioz (*bér-lé-ös*), Hector (1803-69), French musical composer, born

near Grenoble; went to Paris to study medicine, but gave it up for music; brilliant romanticist; considered father of modern orchestration; wrote 'Treatise on Instrumentation', a standard work ('Symphonie Fantastique'; 'Damnation de Faust'; 'Roméo et Juliette').

Bermejo (*bér-má'hó*) River, in n. Argentina; flows s.e. about 1000 mi.: A-280, map A-279

Bermuda grass, a hardy, creeping grass (*Cynodon dactylon*), grown in warm climates for lawns and pastures. Grows to 1 ft.; blossoming spikes bear dark purple florets. Also called wire grass.

Bermuda lily L-136, F-122-6

Bermuda onion O-225

Bermudas, group of islands in Atlantic Ocean; 19 sq. mi.; pop. 30,000: B-99b-100, maps W-72c, N-150c
U. S. air and naval base B-100, map N-51

Bermudez (*bér-mó'dás*), Juan de, Spanish navigator; discovered the Bermudas about 1515.

Bern (*bérn*), cap. of Switzerland; pop. 112,000: B-100-1, S-352, map S-351
monument, picture P-323

Bernadotte (*bér-ná-dót'*), Jean Baptiste Jules (1764-1844), French general; distinguished himself in Napoleonic wars; made marshal of France; elected crown prince of Sweden 1810; succeeded in annexing Norway to Sweden and ruled over both countries as Charles XIV (1818-44); reigning Swedish house descended from him: S-340

Bernard (*bár'né-rá*), Saint, of Clairvaux (1090-1153), French monk, one of most eloquent preachers of Middle Ages; feast day August 20
opposes Abelard A-3
preaches Second Crusade C-404, picture C-405

Bernard, Saint, of Menthon (923-1008), French monk; founded (about 962) the famous hospices conducted by Augustinian monks at the Great and Little St. Bernard passes in the Alps. In 1932 another such hospice was established at the Si-La Pass on the borders of Tibet and Szechwan. Feast day, June 15
St. Bernard dogs rescue travelers D-76

Bernard (*bér-nár'*), Claude (1813-78), French physiologist, discoverer of digestive work of pancreatic juice, sugar-forming work of liver, and existence of vasomotor and vasoconstrictor nerves.

Bernard, Joseph (born 1870), French modernist sculptor ('Woman and Child Dancing') S-62

Bernardin de Saint-Pierre (*bér-nár-dán' dü sán-pé-yér'*), Jacques-Henri (1737-1814), French author; a friend of J. J. Rousseau, and, like him, a champion of the return to nature; broke away from stilted vocabulary of French classical writing ('Paul and Virginia').

Bernardino di Betto. See in Index Pinturicchio

Bernese Oberland, or Bernese Alps, district in Switzerland S-349, map S-351, picture S-350

Bernhardi (*bérn-här'dé*), Friedrich von (1849-1930), German general and author; served in Franco-Prussian War and World War of 1914-18; in his 'Germany and the Next War' (1912) preached doctrine of

force; also wrote 'World Power or Downfall'; 'On War of Today'.

Bernhardt (*bérn'härt*, French *bér-nár'*), Sarah (Rosine Bernard) (1845-1923), French actress, born in Paris of French and Dutch parentage and Jewish descent; baptised Christian at age of 12; made début 1862 and continued to act almost up to time of her death; her great emotional power, rich voice, grace, and vivid personality made her one of the greatest actresses of all time; among her favorite rôles were 'Camille', 'La Tosca', 'Cléopâtre', and 'L'Aiglon': picture D-97

Bernina (*bér-né'nä*), Piz, Alpine peak in s.e. Switzerland, near Italian border (13,295 ft.): picture E-317

Bernini (*bér-né'né*), Giovanni Lorenzo (1598-1680), Italian sculptor and architect of the Baroque period, born Naples; works brought him high reward during his lifetime; most of work now regarded as extravagant and artificial ('Apollo and Daphne'): S-58
colonnade, Rome, picture P-55

Bernoulli (*bér-ng-yé'*), Daniel (1700-82), Swiss mathematician and physicist; wrote on problems of acoustics; worked in differential equations (Bernoulli equation); most important publication 'Hydrodynamica', advances the kinetic theory of gases and fluids.

Bernoulli, Jakob, or Jacques (1654-1705), celebrated Swiss mathematician; voluminous writer on mathematics ('Ars Conjectandi').

Bernstein (*bérn-stán'*), Henry (born 1876), French dramatist; plays are emotional, dramatic, and show more technical skill than artistic merit ('The Thief'; 'The Claw'; 'Judith'; 'Melo').

Bernstorff (*bérn'shtörf*), J. H., Count von (1862-1939), German diplomat; ambassador to U. S. 1908-17; active interest in League of Nations and in disarmament; voluntary exile in Switzerland after 1933 dismissed by Wilson W-168

Berri, John, Duke of (1340-1416), 3rd son of John II (King of France); though cruel, vain, and unscrupulous, he was a patron of arts and letters: L-104, B-176b

Berry, Erick. See in Index Best, Allena Champlin

Berry, Martha McChesney (1866-1942), American educator and philanthropist, born near Rome, Ga.; founded Berry Schools for vocational education of mountain boys and girls, at Mount Berry, Ga.; founded in 1902 with one building, the school grew into an institution covering 35,000 acres, on which practical farming is done by the students ('Martha Berry: the Sunday Lady of Possum Trot', a biography by Tracy Byers).

Berry, small fruit with seeds contained in pulp F-213. See also in Index names of berries, as Blueberry, etc.

Berry lobster L-176

Bersaglieri (*bér-säl-yä'rē*), corps of Italian sharpshooters, noted for endurance and rapid marching; wear distinctive uniform and cocks' feathers in their hats.

Bersem' clover C-282

Berserk (*bér'sérk*), or Ber'serker, in Scandinavian mythology, a warrior who fought fearlessly and wildly

- without armor; 12 sons inherited name and same battling fury; name later applied to bodyguards of Scandinavian leaders.
- Berson** (*bēr'sôn*), Arthur (born 1859), German balloonist B-22
- Bertha**, or **Berthra** (died 783), mother of Charlemagne; celebrated in medieval poems and legends; called "Bertha with the large foot" because one of her feet was larger than the other.
- Berthelot** (*bēr-tū-lō'*), P. E. Marcellin (1827-1907), French chemist, founded synthetic chemistry and thermo-chemistry; proved that organic compounds may be produced outside of living bodies.
- Berthollet** (*bēr-tō-lē'*), Claude Louis, Count (1748-1822), French chemist; first physical chemist; with Lavoisier contributed to modern chemical nomenclature.
- Berthra**, mother of Charlemagne. See in *Index* Bertha
- Bertillon** (*bēr-tē-yōn'*), Alphonse (1853-1914), French anthropologist; devised system of measurements for identifying criminals: F-43
- Bertillon measurements** F-43
- Berwick, Pa.**, borough on Susquehanna River 23 mi. s.w. of Wilkes-Barre; pop. 13,181; railway cars, iron products, silks, flour.
- Berwick-upon-Tweed**, England, frontier town at mouth of Tweed River on Scottish border; pop. 13,000; prominent in border wars: map E-270a
- Ber'wyn**, Ill., residential suburb 10 mi. w. of Chicago; pop. 48,451.
- Beryl**, a mineral G-28, M-184
- Beryllium**, a chemical element C-174, A-132, table C-168
- atomic structure, *diagram* A-361
- Berylune** (*bā-rē-lūn*), fairy in Maeterlinck's 'Blue Bird' M-24
- Berzelius** (*bēr-zē-lē-ūs*), Jöns Jakob, Baron (1779-1848), Swedish chemist; discovered silicon, zirconium, cerium, thorium, and selenium; invented chemical symbols: C-167
- atomic weights C-178
- Besangon** (*bū-zān-sōn'*), France, fortified city on Doubs River 206 mi. s.e. of Paris; pop. 65,000; watches and clocks; Roman remains; birthplace of Victor Hugo
- first rayon factory R-55
- Besant** (*bēz'ant*), Annie (1847-1933), English theosophist, president Theosophical Society after 1907; prominent in socialist and Indian nationalist movements; founded Central Hindu College 1898 and Central Hindu Girls' School 1904, at Benares.
- Besant** (*bē-zānt'*), Sir Walter (1836-1901), English author; his stories of East London life, notably 'All Sorts and Conditions of Men', gave great impetus to social reforms; also collaborated with James Rice.
- Besier** (*bēz'ē-ā*), Rudolf (1878-1942), English dramatist; collaborated with H. G. Wells in 'Kippis' (1912), with Hugh Walpole in 'Robin's Father' (1918); known in U. S. for 'The Barretts of Wimpole Street'.
- Beskov**, Elsa (born 1874), Swedish writer and illustrator of charming books for children; first picture-book 'The Tale of the Wee Little Old Woman' (1897); among others are 'Aunt Green, Aunt Brown, and Aunt Lavender'; 'Olle's Ski Trip'; 'Pelle's New Suit'.
- Besnard** (*bē-nār'*), Paul Albert (1849-1934), French artist, born Paris; highly versatile, noted alike as painter (of landscapes, portraits, and murals) and as etcher; principles of impressionists employed in treatment of color and light, but not in matter of realism.
- Bessara'bia**, district acquired by Rumania 1918; taken by Russia 1940; 17,146 sq. mi.; pop. about 3,000,000: R-194b, map B-18
- Bessborough, Vere Brabazon Ponsonby**, 9th Earl of (born 1880) governor general of Canada 1931-35; had been in British Parliament about 20 years; a director of important business concerns.
- Bes'sel**, Friedrich Wilhelm (1784-1846), German astronomer and mathematician S-273, 274
- Bes'semer**, Sir Henry (1813-98), English inventor of "Bessemer process" of making steel I-142
- works at Sheffield S-106
- Bessemer, Ala.**, iron and steel manufacturing city 10 mi. s.w. of Birmingham, in great Alabama coal and iron ore district; pop. 22,826: map A-98
- Bessemer steel process** I-142-4, 145
- Best**, Allena Champlin (Erick Berry) (born 1892), author and illustrator of children's books, born New Bedford, Mass. ('Winged Girl of Knossos', ancient experiments in flying; 'Homespun', aspects of pioneer life).
- Best**, Herbert (born 1894), English author, born Chester, England; in government service in West Africa; books for children are based on African life and illustrated by his wife, Allena Champlin Best ('Garam the Hunter').
- "Best Friend," one of first locomotives built in America R-37
- Beston**, Henry (originally Henry Beston Sheahan) (born 1888), American writer, born Quincy, Mass.; known for adventure stories, modern fairy tales for children ('Firelight Fairy Books'; 'The Book of Gallant Vagabonds'; 'The Sons of Kai'; 'The Outermost House').
- Bē'ta Centauri**, a fixed star S-274
- Beta rays**, of radium R-32, 34
- Betatron**, beta-ray generator X-202
- Betel** (*bē'tl*), a palm B-101
- nut, *picture* N-188
- Betelgeuse** (*bē'tēl-jūz*), also **Betelgeuse** or **Betelgeux**, a fixed star A-345, S-276, *charts* S-274, 275, 275f, h
- Beth'any**, village near Jerusalem often mentioned in Gospels; home of Mary, Martha, and Lazarus.
- Bethany College**, at Bethany, W. Va.; founded 1840 by Disciples church; arts and sciences.
- Bethany College**, at Lindsborg, Kan.; Lutheran; founded 1881; liberal arts; fine arts.
- Bethel**, Palestine, village ("House of God") 10 mi. n. of Jerusalem (Gen. xii, 8; xxviii).
- Bethel College**, at North Newton, Kan.; Mennonite institution founded 1887; arts and sciences, music, theology.
- Bethes'da**, pool in ancient Jerusalem referred to in the Bible (John v. 2-4) as having miraculous healing qualities.
- Beth'lehem**, Palestine, birthplace of Jesus; pop. 8000: B-101, *pictures* C-226
- Christmas celebration C-229c, *picture* C-226
- Bethlehem, Pa.**, city 55 mi. n. of Philadelphia on Lehigh River and Canal; noted for large iron and steel works and annual Bach musical festivals; pop. 58,490; Lehigh University, Moravian College and Theological Seminary for men, Moravian College and Seminary for women; founded by Moravians: map P-112
- Bethmann-Hollweg** (*bāt-mān-hōl'-vāk*), Theobald von (1856-1921), German statesman, imperial chancellor (1909-17) W-152
- Bethshan** (*bēth'shān*), or **Beth-shean** (*bēth-shē'an*), ancient city in Palestine, 55 mi. n.e. of Jerusalem on site of modern Beisan; Egyptian, Canaanite, and Roman remains; recent excavations include two Egyptian temples built 13th century B.C., in which head and armor of Saul were laid (I Chron. x, 10).
- Bethune** (*bē-thūn'*), David. See in *Index* Beaton, David
- Bethune, John** (1751-1815), Canadian clergyman, born Isle of Skye, Scotland; chaplain in British army in American Revolution; 1786 founded at Montreal the first Presbyterian church in Canada.
- Bethune, Mary McLeod** (born 1875), Negro educator, born Mayesville, S. C.; founded Bethune-Cookman College at Daytona Beach, Fla., which is famous for its extension work among Negroes.
- Betta splendens**, a fish, *color plate* A-233a-b
- Better Business Bureaus**, agencies for promoting honesty, accuracy, and dependability in manufacture and distribution of all commodities; first agency established Minneapolis, 1914.
- Betty lamp** L-56, *picture* A-171
- Betulaceae** (*bēt-yū-lā'sē-ē*), the birch family, including birches, hazels, and alders.
- Beuthen** (*bōit'ēn*), Germany, mining (coal, zinc, calamin) and industrial town in Upper Silesia; pop. 87,000.
- Beverages**
- alcoholic A-112
- carbonated W-46
- plants provide P-245
- soft drinks P-245
- Beveridge**, Albert Jeremiah (1862-1927), American politician, lawyer, and author, born near Hillsboro, Ohio; U. S. senator (Republican) from Indiana 1899-1911 ('Life of John Marshall'; 'Abraham Lincoln').
- Beveridge**, Sir William Henry (born 1879), English economist and sociologist; noted for plan for post-war social security, brought out in December 1942, which would provide compulsory state insurance protecting every person in Great Britain throughout his lifetime from want or insecurity.
- Bev'erly**, Mass., city and summer resort n. of Salem on Salem Bay; pop. 25,537; shoe machinery and shoes; distributing point for Texas oil.
- Beverly Hills**, Calif., beautiful residential city, suburb of Los Angeles; pop. 26,823; home of many motion picture actors.
- Bevin**, Ernest (born 1884), British trade union leader; began trade union career 1911 as secretary of Dockers' Union; 1922 general secretary of Transport and General Workers' Union; 1926 member of general council of the Trades Union Congress, chairman 1936; 1940 made minister of labor and member of Churchill's "inner war cabinet."

- Bevis (*bēvis*), John (1695-1771), English scientist E-231
- Bewick (*bū'ik*), Thomas (1753-1828), English wood engraver; illustrated many books on animals ('Quadrupeds'; 'British Birds'; 'Aesop's Fables'); E-294, L-158
- Bey (*bā*), hereditary title of native sovereign of Tunisia; formerly title of nobility in Turkish Empire; abolished in Turkey, 1934 Tunisia T-151
- Beyle (*bēl*), Marie Henri. *See in Index* Stendhal
- Beyoglu (*bāy'ōg-lū*), also Pera, suburb and foreign quarter, Istanbul, n. of Golden Horn: map I-152
- Beyrouth, Syria. *See in Index* Beirut
- Bez'ant, gold coin of Byzantine Empire, value about \$2.42.
- Béziers (*bāz-yā'*), cathedral town and trade center in s. France; pop. 73,000; massacre of Albigenses in 1209: map F-179
- Bhagavad Gita (*bāg'vād gē'tā*), a Sanskrit dramatic poem forming part of the Mahabharata.
- Bhils (*bēlz*), savage dark-skinned race of central India I-34
- Bhil'sa (*bīl'sā*), village in cent. India over 30 mi. n.e. of Bhopal; famous for old Buddhist memorial shrines (topes); principal one, Sanchi, 6 mi. from village Sanchi tope, gate, picture I-39
- Bhopal (*bō-pū'*), a state of Central India Agency; chief Moslem state of cent. India; 6924 sq. mi.; pop. 730,000; ruled 1844-1926 by women (begums, or princesses); Sultan Jahan Begum (1858-1930) did much to advance position of women, education, and medical aid; in 1926 she abdicated in favor of her son; cap. Bhopal (pop. 61,000): map A-332c
- Bhutan (*bq-tān'*), state in e. Himalayas between Tibet and India; 18,000 sq. mi.; pop. 300,000; agriculture, stock raising; cap. Punaka (Punakha): I-30, maps I-30, 31, A-332c
- Biafra (*bē-āf'rā*), Bight of, large bay on w. coast of Africa at head of Gulf of Guinea.
- Bialik (*bē-ā'lik*), Chaim Nachman (1873-1934), Jewish poet, born in Russia; lived in Palestine after 1923; called poet laureate of the Jewish Renaissance; compiler of old Hebrew poetry and folk-lore; wrote in Hebrew ('The Talmudic Student'; 'The City of Slaughter').
- Białystok (*bē-āl-ē-stōk'*), Polish city 100 mi. n.e. of Warsaw; pop. 98,000; manufactures textiles, leather, hats, soap: map E-326e
- Bianco (*bē-yān'kō*), Margery Williams (born 1881), writer, born London, England; married Francesco Bianco of Italy, 1904; has lived in Italy, France, and U. S.; noted for imaginative stories for younger children ('The Velveteen Rabbit'; 'The Little Wooden Doll'; 'Other People's Houses').
- Bianco, Pamela (born 1906), artist and illustrator, born London, daughter of Margery Bianco, whose 'Little Wooden Doll' she illustrated at age of 14; also illustrated work of other writers: pictures L-113, 114
- Biarritz (*bē-ā-rētz'*), France, watering place on Bay of Biscay near Bayonne; pop. 21,000; summer residence of Napoleon III: map F-179
- Bl'as, one of "Seven Wise Men of Greece" S-193
- Blas, negative, in radio R-21, diagram R-25
- Bible B-101-5
- Abraham A-3-4
- Alexandrine manuscript B-104
- Apocrypha B-104
- Apostles A-229-30
- Bede's translation B-101
- Caedmon's 'Paraphrases' C-11
- "canon" of B-104
- Coverdale's translation B-103, picture B-104
- David D-19
- Douai Version B-103
- Doves Press edition, picture B-181
- Erasmus' edition of New Testament R-74
- Esther E-305-6, picture J-218
- Gospels J-213, P-141
- Gothic translation G-123, B-104
- Gutenberg, Mazarin, or 42-line Bible, first book printed from movable type B-105, P-346, L-102, picture B-179
- influence on language: English E-282, 283, 284; French F-196; German G-62
- influence on literature: Bunyan B-275
- Jesus Christ J-213-14
- Jewish history J-215-17
- Job J-220
- Joseph J-227
- King James Version B-103
- languages in which written B-102-4
- literary value B-102: King James Version W-187
- Luther's translation L-221
- manuscripts B-104, B-178, picture B-102
- Mohammed influenced by M-213
- Moses M-265, pictures J-215, M-146, M-265
- New Testament B-102, 104, A-229-30
- notable Bibles B-103, 104-5, X-198
- Old Testament B-102, 104: divisions P-353; languages in which written H-267
- Paul, Epistles P-90
- Peter, Epistles P-141
- Prophets P-352-3
- Psalms D-19, M-309
- Revised Version B-104
- riddles in R-107
- Ruth R-201-2
- Sinaitic manuscript B-104, B-178, picture B-102
- Solomon S-192
- Tyndale's translation B-103
- Ultilas' translation G-123, B-104
- Vulgate B-103
- Wyclif's translation W-191, B-103
- Ximenes' 'Complutensian Polyglot' B-105, X-198
- Bible box, early colonial desk A-170, picture A-173
- Bible paper P-61
- Bible plays
- mysteries and miracle-plays D-93, M-197
- Passion Play at Oberammergau B-65
- Bibliographical Society of America B-107
- Bibliography, a systematic list of books or other writings relating to a specific subject B-105-7
- Africa A-45
- agriculture A-60
- American Colonies U-255, 256
- American literature A-183
- ancient history A-193
- animals H-313e-f, Z-231
- 'Arabian Nights' A-245
- architecture A-276
- army A-308
- Arthur, King A-316
- Asia A-335-6
- astronomy A-351, H-313h
- athletics and sports H-313c-e
- Australia, New Zealand, and the Pacific Islands A-377
- Austro-Hungarian region A-383
- automobiles H-313i
- aviation H-313b
- Balkan States B-21
- Baltic States R-196
- baseball B-57, H-313d
- basketball H-313e
- Belgium N-75
- biology B-117-18, Z-231
- birds B-146, H-313g, Z-231
- botany B-207, H-313h
- Boy Scouts B-218
- butterflies H-313g
- camping H-313j
- Canada C-57
- carpentry H-313k, I-78
- cats H-313f
- Cervantes C-136-7
- character education C-143
- Chaucer, Geoffrey C-160
- chemistry C-181, H-313h-i
- children's books L-110-21, S-211, S-303l-p
- China C-221p
- Christmas C-230
- Civil War, U. S. U-255, 256
- coins H-313b
- color C-308j
- communication C-324d
- conservation C-345
- conversation C-347d
- cooking H-313j
- Denmark D-54
- Dickens, Charles D-67b
- dogs H-313f
- drawing and modeling H-313l-m
- economics E-154
- education E-188
- electricity H-313i
- Eliot, George E-254
- engineering H-313i
- England G-146
- etiquette E-313
- Europe E-339
- exploration G-38, U-255, 256
- Far West U-255, 256
- fencing H-313c
- fishes H-313f
- fishing H-313c
- flowers H-313h, B-207
- folk-songs M-317
- folk-tales S-303l-p
- football F-152, H-313d-e
- France F-185-6
- games H-313c
- gardens H-313h
- geography G-38
- geology H-313g
- Germany G-77
- gipsies G-91
- golf H-313c
- Great Britain and Ireland G-146
- Hallowe'en H-202
- handicrafts H-313k, I-78
- hobbies H-313-313n, I-78
- home economics H-329
- horses and riding H-313e
- Hugo, Victor H-353
- hygiene P-209
- India I-44
- Indians U-255, 256
- Industrial Revolution I-74p
- industries and industrial arts I-78
- insects H-313g, Z-231
- Ireland G-146
- Italy I-174-5
- Japan J-195
- Kipling, Rudyard K-25
- language and literature L-63
- Latin America L-67r
- Latin American literature L-67x
- leisure L-93d
- letters, collections L-99
- libraries L-106r
- Lincoln, Abraham L-145
- literature for children L-164, L-110-21, S-211, S-303l-p
- Livingstone, David L-169
- Longfellow, H. W. L-194
- magic H-313i-j
- marionettes H-313n
- Mexico N-155
- microscope H-313i

Middle Ages M-162
 Milton, John M-178
 music M-321, 317, H-313m
 mythology M-330
 nature study N-43
 Navy N-56f
 Netherlands and Belgium N-75
 North America N-155
 Norway S-341
 Pacific Ocean A-377
 painting P-31
 pets H-313f
 photography H-313i
 physics P-197, H-313i
 physiology and hygiene P-209
 pioneer life P-221, U-255, 256
 plant life B-207, H-313h
 play production H-313m-n
 Poland R-196
 political science P-295
 polo H-313c
 Portugal S-234
 psychology P-363
 puppets H-313n
 races of mankind R-12
 radio H-313i
 railroads H-313k-l
 reading R-58
 Renaissance and Reformation R-78
 reptiles H-313g
 Revolution, American U-255, 256
 Russia, Poland, and the Baltic States R-195
 safety S-3
 sailing, H-313a
 Scott, Sir Walter S-51
 sculpture S-66
 seashore H-313f-g
 Shakespeare S-100g-h
 ships H-313a-b
 skating H-313c
 skiing H-313c
 sociology and social science S-187-8
 song books H-313m, M-317
 South America S-211
 Spain and Portugal S-234
 sports and athletics H-313a, b, c-e
 stamp collecting S-269, H-313b
 story book L-110-21, S-303, 303l-p
 story-telling S-303
 Sweden and Norway S-341
 Swift, Jonathan S-344-5
 swimming H-313c
 Swinburne, Algernon C. S-348
 Switzerland S-357
 tennis H-313c-d
 Thackeray, William M. T-73
 travel G-38
 trees B-207, H-313h
 United States U-205
 United States history U-255-6
 vocational guidance V-330
 Washington, George W-22
 zoology Z-231

Bibliophile, a lover of books B-188

Bibliothèque Nationale (bē-blē-ō-tēk' nās-yō-nāl'), national library of France L-104-5

Bicameral legislature M-160, A-154

Bicar'bonate, an acid salt of carbonic acid in which the radical (CO₃) is combined with an atom of hydrogen and a metal; also called acid carbonate
 ammonium A-188
 soda (baking soda) S-189, 190, B-15

Bi'ceps muscle M-304, picture M-304

Bichat (bē-shā'), M. F. X. (1771-1802), French anatomist and physiologist, founder of general anatomy; first to show similarity of tissues in all organs of the body.

Bichlo'ride of mercury, or corrosive sublimate, an antiseptic; also a violent poison: M-120
 poisoning and antidote P-274, F-64

Bick'erstaff, Isaac, pen name of Richard Steele as editor of the *Tatler*; previously used by Jonathan Swift.

Bicus'pid teeth T-28, pictures T-29

Bicycles and motorcycles B-107, pictures T-123, V-266c
 safety measures S-2h, picture S-2i

Bid'deford, Me., manufacturing city and summer resort, 15 mi. s. of Portland and 5 mi. from sea on Saco River; pop. 19,790; cotton goods, machinery, lumber, matches, shoes; settled in 1630: map M-38

Biddle, Francis (born 1886), American lawyer and public official, born Paris, France, of American parents; U. S. solicitor general 1940-41; made U. S. attorney general 1941.

Biddle, George (born 1885), painter, lithographer, and writer on art, born Philadelphia; best known for penetrating, sometimes satirical, portraits and for mural panels; advocate of federal art patronage.

Biddle, John (1615-62), English religious teacher, sometimes called founder of Unitarianism; repeatedly imprisoned for his heresy, and finally died in prison.

Biddle, Nicholas (1786-1844), American statesman, financier, and author, born Philadelphia; U. S. representative 1810-11; president of the second Bank of the United States 1822-36; author of 'History of the Expedition of Captains Lewis and Clark'.

Bidwell, John (1819-1900), pioneer rancher and politician in California, born Chautauqua County, N. Y.; emigrated from Missouri 1841; fought in Mexican War, prospected for gold, settled on Rancho Chico; elected to Congress in 1864.

Biedermeier (bē'dēr-mī-ēr'), name given to a style of furniture originating in Germany in early 19th century; simple and architectural in design.

Biedny, Demyan. See in Index Byedny

Bielefeld (bē'lē-fēlt'), Germany, linen manufacturing town in Westphalia, 58 mi. s.w. of Hanover; pop. 115,000.

Biencourt de Poutrincourt, Jean de, Baron de St. Just (died 1615), Canadian soldier and colonizer, born Picardy, France; 1603 joined S'eur de Monts' colonization expedition to Acadia; 1606 took part in Champlain's explorations of the Bay of Fundy.

Bienne (bē-ēn'), or Bieler, lake in Switzerland, 16 mi. n.w. of Bern; at foot of Jura Mts.; about 20 sq. mi.; contains island of St. Pierre, residence of Jean-Jacques Rousseau in 1765.

Bien'ial plants P-244
 familiar weed types W-64
 in gardens G-10-11

Bienville (bē-yān-vēl'), Jean Baptiste Lemoyne, Sieur de (1680-1768), French-Canadian soldier and colonial officer, member of the famous Lemoyne family; founded Mobile, Ala. (1702) and New Orleans, La. (1718): N-103, A-98f

Bierce, Ambrose (1842-1914?), American writer, born Meigs County, Ohio; served in Civil War; journalist in London and later in California; went to Mexico and disappeared, 1914, conflicting accounts being given of his death; skilful writer of short stories, especially of fantastic and supernatural tales in style of Poe; also wrote satirical verse and essays; called "bitter Bierce" because of cynical attitude toward life ('In the Midst of Life'; 'Can Such Things Be?').

Bierstadt (bēr'stāt'), Albert (1830-1902), American landscape painter, born Solingen, Germany; famous for his paintings of Rocky Mts. and other parts of w. U. S.

Bifocal lens, in spectacles S-240

Big Belt Mountains, in central Montana, map M-243

Big Ben, great bell in Westminster clock tower, London; weight 13½ tons, 7½ ft. high, 9 ft. in diameter at mouth, note is E sharp. Cast 1858 to replace former bell which cracked (1852) while it was being tested. Present bell also cracked shortly after it was hung but proved serviceable after crack was widened and smoothed. Named for Sir Benjamin Hall who had charge of the work on the first bell. "Big Ben," which rings the hours, is flanked in tower by smaller "quarter" bells. The name is commonly applied to clock as well as bell: L-188, pictures L-183, L-185
 clock size and mechanism W-37

Big Bend National Park, Texas N-20

Big Bend State, popular name for Tennessee T-45

Big Bertha, German siege gun A-320

Big Black Mountain, a peak of the Cumberland Mts. in Harlan County, s.e. Kentucky; highest point in state; 4150 ft.

Big Black River, in w. Mississippi, flows through rich cotton-producing plain to Mississippi River, about 250 mi.: map M-200

Big Blue River, rises in Nebraska, flows south to Kansas; joins Smoky Hill River to form Kansas River at Manhattan; about 300 mi. long.

Bigcone-spruce, rare evergreen tree (*Pseudotsuga macrocarpa*) of pine family, native to mountains of s. California and Mexico. Grows 30 to 60 ft. high in dry, rocky places, at 3000 to 5000 ft. altitudes. Similar to Douglas fir. Branches long, drooping; leaves blue-green. Wood used as firewood.

Big Cypress Swamp, Fla. F-116, maps F-111, 112

Big Dipper, seven bright stars in the Great Bear constellation, charts A-341, S-275a, c, d, f, g
 Greek legend C-347

Big'elow, Erastus Brigham (1814-79), American inventor, born Worcester, Mass., picture I-115
 carpet-weaving machine R-174

Bigelow, John (1817-1911), American journalist and diplomat; managing editor *New York Evening Post* 1849-61; minister to France 1864-67; discovered original manuscript of Benjamin Franklin's 'Autobiography' and edited first complete edition; wrote 'Retrospections of an Active Life'.

Bigelow, Poultney (born 1855), American traveler and writer, born New York City; founded and edited *Outing*; correspondent *London Times* in Spanish-American War ('The German Emperor and His Eastern Neighbors'; 'Bismarck'; 'The Borderland of Czar and Kaiser'; 'Seventy Summers').

Big Hole Battlefield, national monument in Montana N-20

Bighorn, Rocky Mountain sheep B-108, R-123
 allied species S-104

Big Horn Mountains, range of Rocky Mts. in Wyoming and Montana; many peaks, mountain lakes, and waterfalls; highest point, Cloud Peak (13,165 ft.): map W-194

Key—cāpe, āt, fār, fāst, whāt, fāll; mē, yēt, fērn, thāre; ice, bīt; rōw, wōn, fōr, nōt, dō; cāre, būt, rȳde, fȳll, būrn;

Big Horn River, rises in Rocky Mts., in central Wyoming; flows 450 mi. n. to Yellowstone River: *maps W-194, M-243*

Bight, of rope K-34, *picture K-35*

Big Inch pipe line, *picture P-152*

Bigleaf maple, tree (*Acer macrophyllum*) of maple family, native from British Columbia to California. Grows 30 ft. to 100 ft. Leaves, heart-shaped with 3 to 5 lobes, 8 in. to 18 in. long. Flowers yellowish green, in drooping clusters. Wood medium hard, used for veneer and lumber; tree and wood sometimes called Oregon maple.

'Big'low Papers, The, series of dialect poems by J. R. Lowell, in which he speaks through imaginary author, Hosea Biglow, shrewd humorous Yankee: L-210, C-250

Bignonia (*big-nō'ni-ā*), a genus of perennial plants, found in the tropics; showy, trumpet-shaped flowers, red, yellow, and purple; cross-vine, so called because a cut stem shows a cross pattern; is highly regarded by natives of South and Central America. This group not to be confused with trumpet-vine genus.

Bignonia family, or **Bignoniaceae** (*big-nō-ni-ā'sē-ē*), a family of plants, shrubs, vines, and trees, native chiefly to warm regions, including bignonia, catalpa, trumpet-flower, jacaranda, cape honeysuckle, flowering willow, and calabash tree.

Bigot, François (flourished 1703-60), intendant of New France (Canada) (1748-59); born Bordeaux, France; known for his corrupt and tyrannical rule; 1759 arrested in France, imprisoned, and finally banished from kingdom.

Big River, in Quebec, rises in central part, flows w. 520 mi. to James Bay: *map C-58*

Big Sandy River, tributary of Ohio River; with e. branch (Tug Fork) forms boundary between Kentucky and West Virginia: *maps W-76, K-11*

Big Sioux River, flows s. (300 mi.) through fertile plains of South Dakota, forming boundary between Iowa and South Dakota, for last half of its course: *map S-218*

Big Spring, Tex., city in w., 203 mi. s. of Amarillo; pop. 12,604; oil producing and refining, agriculture, stock raising; cotton interests; railroad shops.

"Big Stick" policy, of President Theodore Roosevelt M-241

Big Stone Lake, forms part of boundary between Minnesota and South Dakota; 25 mi. long and 3 mi. wide: *map S-218*

Big Ten, the Western Intercollegiate Conference, in football F-151c

"Big trees", the Washington, or giant, sequoia, and redwoods S-79-80 oldest living organisms T-130 Sequoia and General Grant parks N-22b, d, *picture C-27* Yosemite region Y-208

Big White (1765-1810?), Mandan Indian chief; aided Lewis and Clark Expedition; received a medal and a trip to Washington in 1806.

Bihzad, also Behzad (1460?-1524?), Persian miniature painter, active 1478-1500; master colorist, painted realistically; called "marvel of the age"; notable influence on subsequent Persian art.

Bijanagar. See in *Index* Vijayanagar

Bikaner (*bē-kā'nēr*), India, cap. of

native state of Bikaner, in Rajputana Agency, 250 mi. s.w. of Delhi; pop. 86,000: *map A-332c*

Bilateral agreements, in foreign trade I-111

Bilbao (*bil-bā'ō*), chief seaport of n. Spain, on Nervion River, 8 mi. from Bay of Biscay; pop. 160,000; exports iron ore from nearby mines; long famous for sword blades (called "bilbos"): *map S-226*

Bilberry (blueberry) B-159

Bil'dad, one of Job's friends, a Shuhite, who falsely comforted him with "words without knowledge"

Bilderdyk, or **Bilderdyk** (*bil'dēr-dik*), Willem (1756-1831), Dutch poet, philologist, and philosopher; exiled from Holland for a time as a monarchist; upon his return became librarian of Louis Napoleon and later president of the Royal Institute ('The Disease of Genius'; 'The Destruction of the First World').

Bile, a secretion of the liver L-165

Bile duct L-165

Bill, Alfred Hoyt (born 1879), American writer, born Rochester, N. Y.; instructor in English; served in army as captain and regimental adjutant 1910-16; captain American Red Cross, A. E. F., 1918; author boys' adventure stories ('Red-Prior's Legacy'; 'Clutch of the Corsican').

Bill, in U. S. Congress, how it becomes a law C-332, *diagram C-333*

Bill, of birds, *color plate B-130*

duck, *picture D-116*

toucan T-116, *color plate B-130*

Billet, steel I-145

Billiards B-108-9

balls B-108; celluloid C-123; ivory I-176

Billings, Josh, pen name of Henry Wheeler Shaw (1818-85), American humorist, born Lanesborough, Mass.; said, "It's better not to know so many things than to know so many things that ain't so."

Billings, William (1764-1800), first American professional writer of music, born Boston.

Billings, Mont., metropolis of stock-raising and agricultural district, on Yellowstone River in s.; pop. 23,261; oil wells near by; beet-sugar and canning factories, flour mills, foundries; Billings Polytechnic Institute, Eastern Montana State Normal School: M-246, *map M-243*

Billingsgate, London's famous fish market, near London Bridge; hence, coarse and abusive language, such as is heard there.

Billings Polytechnic Institute, at Polytechnic, Mont.; founded 1908; Polytechnic-Intermountain College of arts and sciences, schools of technology, business, music.

Bill of attainder. See in *Index* Attainder

Bill of exchange C-393-4, F-153

American Colonies A-158

international trade I-110d

Bill of lading, a written acknowledgment of goods received for transportation issued by the master of a ship; acts as a contract to deliver the goods; when issued by a railroad such a bill is called a way bill.

Bill of rights

English B-109

French declaration of rights B-109

state constitutions A-317, B-109

U. S. Constitution B-109, U-210:

Patrick Henry secures adoption

H-280; text U-216-17

Bill of sale, a formal written state-

ment of the sale of personal property; necessary when the transfer of the property does not occur at once.

"Billy the Kid" (William H. Bonney) (1859-81), famous outlaw of the Southwest, born New York City; spent early life in Kansas and Colorado and about 1865 moved to New Mexico; became leader of an outlaw band in various cattle wars and made a record of 21 killings; finally shot and killed by Sheriff Garrett at Fort Sumner, N. M.

Biloxi (*bī-lōx'i*), tribe of Siouan Indians, some of whom still live in Louisiana, others with the Choctaw and Caddo in Oklahoma.

Biloxi, Miss., winter resort and important market for oysters and shrimps on Biloxi Bay, Gulf of Mexico; pop. 17,475; canned fish, fruit, and vegetables; settled in 1699 by Iberville; first permanent white settlement in Mississippi valley: *map M-200*

Bimet'allism M-220b. See also in *Index* Silver, free coinage of

Bimini (*bē-mi-nē*), fabled island of the Bahama group, site of the legendary "Fountain of Youth" sought by Ponce de León P-302

Bimini Islands, group of small islands in the Bahamas, about 40 mi. e. of Florida; consists of 2 main islands and a few smaller ones; only North Bimini is inhabited; area 8 sq. mi.; pop. 600.

Binary (*bī'nā-ri*) stars, or double stars S-272

Binder twine, sisal used for S-154

Binding of books B-182-3. See also in *Index* Bookbinding

Bindweeds. See in *Index* Convolvulaceae

Binet (*bē-né'*), Alfred (1857-1911), French experimental psychologist; made study of hypnotism and various phases of pathological psychology, but chiefly known for his work in trying to measure human intelligence: P-362, I-96

Binet-Simon tests I-96

Bingen (*bīng'ēn*), Germany, picturesque old town on Rhine 15 mi. w. of Mainz; pop. 10,000: *map G-66* Mouse Tower R-93, *picture G-71*

Bingham, George Caleb (1811-79), American painter and politician, born Augusta County, Va.; lived in Missouri from boyhood and painted popular scenes and characters, often political in theme; state treasurer 1862-65; adjutant general 1875.

Bingham, Hiram (born 1875), explorer and senator, born Honolulu, Hawaii; directed Peruvian expeditions for Yale University and National Geographic Society 1911-15; explored ruins of Machu Picchu and Vitcos, last Inca capital; U.S. senator from Connecticut 1924-33 ('In the Wonderland of Peru'; 'Inca Land'; 'Machu Picchu').

Bingham (*bīng'am*) Canyon, or **Bingham**, Utah, mining town 20 mi. s.w. of Salt Lake City; pop. 2834: *map U-264* copper mine U-264, C-359, *picture U-265*

Bingham Purchase, two tracts of land in Maine, each of one million acres between Penobscot and St. Croix rivers, offered at lottery by Massachusetts 1786; William Bingham, a Philadelphia banker, was largest purchaser.

Binghamton, N. Y., industrial city at

- junction of Susquehanna and Chenango rivers, 67 mi. s.e. of Syracuse; important manufacturing center; shoes, cigars, cameras, machinery; pop. 78,309; map N-114
- Bingyi** (*bing-gē'*) caves, in Burma, picture B-259
- Binh-Dinh** (*bin'y'-din'y'*), largest town in Annam, French Indo-China; pop. 145,000; near e. coast 10 mi. n. of its port Quinhon (Kwinhon), a shipping center for rice, sugar, cotton; map A-332c
- Bin'nacle**, a case or stand for ship's compass C-326
- Binocular**, field glass T-39
- stereoscopic principle** S-286
- Binocular vision** E-350, S-286, S-77
- Bino'mial**, from Latin, "double name" algebra A-123
- biology**, nomenclature L-148
- Binyon**, Laurence (1869-1943), English poet, art historian, and literary critic; in charge of oriental prints and drawings, British Museum ("The Four Years", war poems; "Poems of Nizami"; "Boadicea", drama; many works on art).
- Bio-Bio** (*bē'ō-bē'ō*) River, in Chile, rises in the Andes and flows n.w. into the Pacific at Concepción; about 240 mi. long.
- Biochemistry**, chemistry of living matter and vital processes B-109-11. See also in *Index* Physiology; and chief subjects listed below
- carbohydrates B-109
- carbon compounds (organic) C-176a
- digestion D-68-9
- enzymes E-298-9, B-109, P-120
- fats and lipins B-109
- fermentation F-24
- hormones G-99-100, B-110
- metabolism B-110
- methods of analysis B-111; centrifuge and ultra-centrifuge devices C-134
- muscular action B-110
- oxidation B-110
- photosynthesis B-110-11, P-238
- proteins P-356, B-109
- protoplasm P-356, B-109
- respiration R-79-80, B-110
- vitamins V-310-12
- Biodynes** (*bi'ō-dīns*), substances resembling hormones that stimulate cell reproduction; discovered 1935-40 by George Sperti; used in treatment of burns.
- Biogenesis**, the theory that all living forms spring from a living parent organism. It is opposed to the theory of abiogenesis, or spontaneous generation, that life can come into being from non-living matter.
- Biog'raphy**, a written account of a person's life; autobiography is the story of one's life written by himself
- American literature A-182
- writing of W-190
- Biological Survey**, Bureau of, U. S. government, consolidated, 1940, with U. S. Bureau of Fisheries to form the Fish and Wildlife Service. See Fish and Wildlife Service
- Biology**, the science of life B-111-16, Outline B-116-18. See also in *Index* Adaptation; Anatomy; Biochemistry; Biometry; Botany; Life; Physiology; Reproduction; Zoölogy; and chief subjects below
- animal kingdom A-198-203
- animals distinguished from plants B-111-12, A-199, P-237: slime molds S-163, P-236
- bibliography B-117-18, Z-231
- cells as life units C-121-2, B-112, pictures B-113, C-121, 122, H-285
- chemistry of life processes B-109-11, C-176a: digestion D-68-9; enzymes E-298-9; plants P-238; protoplasm P-356, B-112
- conditions necessary for life B-112
- ecology E-145a-46
- effects of radiation on life: ultra-violet rays R-15, V-311a, 312, X-rays X-201
- embryology E-258-9, B-114-15, E-192
- evolution E-340-3: Darwin D-15-16
- heredity H-283-6, B-115
- mathematical methods in B-118-19
- nomenclature B-116, A-199-202, L-148-9, B-132, diagram A-200, Outline Z-227-30
- origin of life B-114-16, E-341
- parasites P-67-70
- plant life P-234-46
- prehistoric life B-115: animals A-204-10
- Bio-luminescence**, the emission of light by living organisms due to the slow oxidation of certain substances manufactured by them P-176
- Biometry**, the study of biological problems by mathematical and statistical methods B-118-19
- Bion** (*bi'ōn*), Greek pastoral poet of second half of 2d century B.C.; younger contemporary and imitator of Theocritus; style graceful but over-sentimental, typical of late pastoral poetry; long descriptive epic "The Dirge of Adonis" influenced Shelley's "Adonais".
- Biotin** (vitamin H) V-312
- Bi'otite**, a black mica M-184
- Bi'plane**, airplane with two sustaining surfaces, one above the other A-70, pictures A-66, 70
- Wright brothers' first airplane W-183-4
- Birch**, Reginald Bathurst (1856-1943), artist, born London, moved to U.S. 1860; illustrated stories and poems, notably Frances Hodgson Burnett's "Little Lord Fauntleroy".
- Birch**, tree B-119, pictures T-132, 134
- bark stripping, picture C-75
- far north T-136
- leaf, pictures B-119, T-135
- Sweden S-335
- Birch-bark basket**, picture I-61
- Birch-bark canoe** B-161, 163, B-119
- making C-76
- Birch family** (*Betulaceae*), a family of trees and shrubs; includes alder, birch, hazelnut, and hornbeam.
- Bird banding** B-144, picture B-141
- gulls and terns G-185
- Bird Day**, observed by schools in at least 30 states of the U.S.; date usually designated each year by proclamation of state governor; purpose, to teach the appreciation and protection of birds.
- Bird houses** B-141-2, pictures B-141, 143
- "Bird in the hand is worth two in the bush," origin C-136
- "Bird-Lore", magazine B-145d
- motto B-144
- Bird-of-paradise flower**. See in *Index* Strelitzia
- Bird reservations** B-146. See also in *Index* Birds, subhead protection
- Birds** B-120-46, color plates B-133-40, Outline Z-229, N-42. See also in *Index* the various birds, such as Auk, etc.
- Antarctica A-216
- attracting birds, devices B-141-2
- Audubon's contribution to ornithology A-363
- banding B-144, picture B-141
- beak or bill: duck, picture D-116; habits shown by, color plate B-130; parrot, color plate P-83-4; toucan T-116, color plate B-130
- bones, why hollow B-120
- books about B-146, H-313g, N-43, Z-231
- classification of B-132
- claws on wings, picture B-121
- coloration B-130-2: eggs B-127; male and female, differences B-131; protective P-354; young birds B-132
- conservation. See subhead protection
- courtship and mating B-124-5: birds of paradise, color plate P-64-5; crane, picture B-125; frigate bird F-206; grouse G-180; lyre-bird L-224; stork S-294
- economic value B-121-3, B-144, 146
- bluebird B-159
- cuckoo C-413
- finches F-35
- gulls and terns G-186
- hawks H-245-7
- kinglet K-22
- meadowlarks M-95
- nighthawks, whippoorwills N-144
- ostrich O-253
- owls O-256-7
- potato-bug enemy P-326
- quail Q-1
- sparrows S-238, C-235
- swallows S-332
- swifts S-332
- titmouse T-99
- warblers W-7
- woodpecker W-134
- eggs and incubation B-125-8, E-192, pictures B-124, E-193: color of eggs, why varied B-126-7; laying in other birds' nests C-413, picture B-124; male birds that brood B-131, O-253, picture E-263; number of eggs and size B-127-8
- evolution B-120-1, diagram A-200: archaeopteryx A-210, picture B-121; feet, pictures B-129
- extinct B-145a-b, C-343: dodo D-75; great auk A-364, picture A-365; moa, picture T-19
- feathers F-20-1, B-129-32. See also in *Index* Feathers
- feeding devices for lawns and gardens B-141, pictures B-144, 145
- feet, pictures B-129
- fishing with cormorants in China, picture C-218
- flying: airplane compared to B-120-1, picture A-81; distance record G-185
- food B-121-3, 141, pictures B-120: cultivating plants for B-142; robbing other birds F-206; young birds B-128
- game B-123: colonial times B-145a; protection B-145c-46
- geographic distribution B-124: group most widely distributed G-185
- houses B-141-2, pictures B-141, 143
- Indian legends F-139
- land birds Z-229
- largest bird family F-35
- largest of all birds O-253
- mating. See above courtship
- migration M-163-4, B-124, 146, picture-maps M-163, 164, 166
- Arctic tern G-185, M-163
- blackbirds B-152
- bobolink B-166, M-163
- daylight migrations S-332
- ducks D-117
- geese G-120
- grosbeak G-178-9
- gulls and terns G-185
- humming-birds H-356
- long distance record G-185
- plover, golden M-163-4, P-259
- ptarmigan, or snow grouse G-181
- rails R-35
- robins R-118
- swallows S-332
- swifts S-333
- whippoorwill W-85
- wood ibis S-294

Key—cāpe, āt, fār, fāst, whāt, fāll; mē, yēt, fērn, thēre; ice, bīt; rōw, wōn, fōr, nōt, dē; cūre, bāt, rēde, fūll, bārñ;

mimics: catbird C-98; lyre-bird L-224; mocking-bird M-213
molting B-129-30, F-20
nests B-125-6, 141, *pictures* B-124, 127; Chinese soup from swift nests S-333; community nests B-125, S-296, W-62; inherited building habits B-221, E-162; location, selection B-124; orioles constructing, *picture* O-250; robin, *picture* R-118; suitable vegetation for B-142; time required to build B-126
North American types, *color plates* B-133-40
omens in Borneo B-196
pets P-155-6
photographing N-36, B-142, 144, *pictures* N-32
preserving and mounting T-18-19
protection B-144-6, E-145e, *pictures* E-145f; Audubon Societies A-363, B-145d, 146, S-297; coloring P-354, B-132; Delaware D-40a; Florida F-115; Hawaii H-243; paradise birds P-66; pelican P-103; tree device, *picture* B-145
running birds Z-229
sanctuaries, or refuges. *See subhead* protection
skeleton B-120, *picture* S-155
state birds, *table* B-122
stories: 'Old Abe, the War Eagle' E-125-6. *See also in Index* Stories, *subhead* bird stories and articles for young readers
study B-123, 142, 144, N-42; banding birds B-144, *picture* B-141
talking: crow C-403; parrot, macaw, cockatoo P-82; raven R-53
taxidermy T-18-19
teeth: primitive birds B-120, *picture* B-121
vision B-121: nocturnal birds O-256
vocal organs B-125
water birds Z-229; conserving B-145b-c, *pictures* B-145d, E-145f
wings B-121, *picture* H-208; penguin P-110; greatest spread A-108-9
young, care of B-128
'Birds' Christmas Carol, The, story by Kate Douglas Wiggin; the heroine is Carol Bird, an invalid girl born on Christmas Day.
Birdseye, Claude Hale (1878-1941), American topographic engineer, born Syracuse, N. Y.; led expedition by boat through Grand Canyon of Colorado River in 1923.
Bird's-eye maple, or curly maple M-56
ash a substitute A-323
Birds-eyes. *See in Index* Gilia
Bird's-foot trefoil. *See* Trefoil
Bird's-nest soup S-333
'Birds of America', by Audubon A-363
Birds of Paradise P-62, 66, *color plate* P-64-5
Birds of prey, chiefly birds of orders *Falconiformes* and *Strigiformes* B-132, *Outline* N-42, *color plate* B-135
buzzard B-288
condor C-328-9
eagle E-123-5
hawk, falcon, and osprey H-245-7
kite K-26
owl O-256-7
secretary bird S-73
shrike S-135, B-132
vulture V-336
Bird-spider S-257, *picture* S-257
'Bird Woman,' or Sacajawea (1788?-1812), guide for Lewis and Clark. *See in Index* Sacajawea
Bireme (*bī'rēm*), ancient ship S-118
Biret'a, cap worn by Catholic clergy; pope wears white; cardinal, red; bishop, purple; others, black.

Birger (*bīr-yēr'*), Jarl of Bjälbo (died 1266), regent of Sweden 1250-66; built Stockholm; conquered Finland.
Birgitta (*bīr-yē'tā*), Saint. *See in Index* Bridget of Sweden
Birkenhead, Frederick Edwin Smith, first Earl of (1872-1930), British Conservative statesman and lawyer; attorney general, 1915-19; Lord High Chancellor, 1919-22; secretary of state for India, 1924-28; writer on politics and law ('International Law'; 'Contemporary Personages'; 'Fourteen English Judges'; 'Famous Trials of History').
Birkenhead, England, seaport and shipbuilding center on Mersey River opposite Liverpool; pop. 150,000; L-166, *map* E-270a
Birmingham, George A., pen name of Canon James Owen Hannay (born 1865), Irish clergyman and novelist ('The Seething Pot'; 'Spanish Gold'; 'Gossamer'; 'The Island of Mystery'; 'The Mermaid').
Birmingham (*bēr'mīng-hām*), Ala., chief city of the state; pop. 267,583; "Pittsburgh of the South": B-146-7, A-98b, *map* A-98, *pictures* A-97, 98c
natural gas pipe lines supply G-24
Birmingham (*bēr'mīng-ām*), England, 113 mi. n.w. of London; pop. 1,000,000; B-147, *map* E-270a
Birmingham, Mich., trade and industrial center 18 mi. n.w. of Detroit; pop. 11,196.
Birmingham-Southern College, coeducational institution of higher learning at Birmingham, Ala.; made up of Southern University, founded 1859 at Greensboro, Ala., and Birmingham University, founded 1898; two combined 1918 at Birmingham; under auspices of Methodist Church.
Birney, James G. (1792-1857), American reformer, born Danville, Ky.; leader of moderate abolitionists; Liberty party candidate for president 1840 and 1844: C-249
Birney, Mrs. Theodore W., founder of National Congress of Mothers P-70
Birobidjan (*bē-rō-bī-jān'*), or Birobidzhan, Jewish autonomous region of the U.S.S.R., on Amur River in e. Siberia; pop. 110,000; cap. Birobidjan (pop. about 20,000); some mining, chiefly agriculture.
Birrell, Augustine (1850-1933), English essayist and political leader; chief secretary for Ireland 1907-16; his individual and witty method of writing has been called "birrelling" ('Obiter Dicta'; 'Men, Women, and Books'; critical biographies of Charlotte Brontë, William Hazlitt, Andrew Marvell; 'Collected Essays').
Birthday stones G-25
Birthdays, of famous men and women, lists A-445-7, H-320-3
Birth rate P-304, P-310, *pictograph* P-304b
Birthwort family, or Aristolochiaceae (*ā-ris-tō-lō-ki-ā'sē-ē*), a family of plants and shrubs, native chiefly to South America, including Dutchmans-pipe, pelican-flower, Virginia snakeroot, calico-flower, and wild ginger.
Bisbee (*bīz'bē*), Ariz., chief copper-mining and smelting town in s.e. of state; pop. 5853; also gold, silver, and lead mining: *map* A-289
Biscay, Bay of, part of Atlantic Ocean w. of France and n. of Spain, *map* E-326d
Biscayne (*bīs-kān'*) Bay, on s.e. coast of Florida M-145, *map* F-111

Biscoe, John, English master of merchant ship; discovered Enderby Land, Biscoe Islands, and Graham Land in Antarctic 1831.
Biscuit, in pottery. *See in Index* Bisque
Biscuits B-229, 232
Bisharin (*bīsh-ā-rēn'*), African tribe A-39
Bishop, Sir Henry Rowley (1786-1855), English composer; wrote many operas, cantatas, etc., but best known for glees and songs, including music for 'Home, Sweet Home'.
Bishop, Katherine S. (born 1889), American pathologist and physician, born New York City; co-discoverer of vitamin E.
Bishop (from Greek *episkopos*, an overseer), title of highest ranking clergy in certain branches of Christian church; functions in general include the ordination of priests and lower clergy, administration of confirmation; in Roman Catholic church symbols are the miter, jeweled ring, pastoral staff and throne (*cathedra*) in cathedral church
cathedral, seat of C-100
investiture conflict: Henry IV of Germany H-274-5, G-177; William II of England W-102
medieval church C-232
Bishop's College, University of, at Lennoxville, Quebec; Church of England; incorporated 1843 (university charter 1853); arts, divinity.
Bishops' Wars, in Scotland S-46-7
Bis'kra, Algeria, winter resort and important military post in fertile oasis 120 mi. s.w. of Constantine; pop. 11,000; scene of Robert Hichens' novel 'The Garden of Allah': *map* A-127, *picture* A-125
Arab schoolboys, *picture* A-32
Bismarck, Otto von (1815-98), German soldier and statesman B-147-8, G-73
Franco-Prussian War F-187-8
minister under William I W-99-100
William II dismisses W-100
Bismarck, N.D., cap., on Missouri River, pop. 15,496; wholesale center for w. N. D.; lignite coal and flour; near by is Fort Lincoln, last command of Custer: *map* N-162
Lewis and Clark near site L-99
Bismarck Archipelago (formerly called New Britain Archipelago), group of islands n.e. of New Guinea consisting of New Britain (formerly New Pomerania), New Ireland (formerly New Mecklenburg), Lavongai (New Hanover), Admiralty Islands, and whole chain of lesser islands; area 19,200 sq. mi.; pop. about 160,000; a German protectorate 1885-1919: N-85, *map* P-10b
Bismarck Sea, battle of W-178z
Bismuth (*bīz'mūth*), a metallic chemical element B-148, *table* C-168
alloys for low-temperature melting A-132
electrochemical activity E-239
Bi'son, or "American buffalo" B-148-51
Alberta herd A-111
"Buffalo Bill" B-262
catalo B-151, *picture* C-106
fossils, New Mexico A-148
stampede, *pictures* B-149
Bispham (*bīs'fām*), David Scull (1857-1921), American operatic barytone, born Philadelphia, Pa.; success in Wagnerian rôles; as concert singer one of first to use English translations of German songs.
Bisque (*bīsk*), or biscuit, term applied to pottery ware after first firing

and before it has been glazed dolls made of D-86 firing P-328

"Bit," popular name for a real, an old Spanish coin, worth about 12½ cents; hence, "2 bits," "4 bits," and "6 bits," meaning 25, 50, and 75 cents respectively.

Bites, of dogs, cats, and insects first aid F-66

Bithynia (*bi-thin'i-ä*), ancient country in Asia Minor on Black Sea.

Bitlis (*bit-lēs'*), trade center in Asiatic Turkey, 120 mi. s.e. of Erzerum; occupied by Russians (1916) in first World War.

Bitolj (*bē-tōl'*), Yugoslavia, also Monastir, commercial town 85 mi. n.w. of Saloniki; pop. 33,000; formerly important Turkish garrison; taken by Serbia 1912: map E-326e

Bitter, Karl (1867-1915), American sculptor, born Austria; came to U. S. 1889; versatile and highly skilled (huge relief in Pennsylvania Railroad Station, Philadelphia; bronze doors for Trinity Church, New York City; portrait statues): S-64

Bitter almonds A-133 oil, from benzene C-289

Bitter ash. *See in Index* Quassia

Bittern, a marsh bird, also called thunder-pumper or stake-driver B-151, pictures B-151, B-128, 131 nest, picture N-33 protective coloration, picture B-131

Bitter-nut (*Hicoria minima*), a species of hickory similar to the pig-nut; thin-shelled nuts extremely bitter; wood hard and strong.

Bitter-root, North American plant (*Lewisia rediviva*) with a bitter, tough edible root, sometimes used as food by the Indians; leaves grow in clusters from the root about a fleshy stalk bearing a single rose-colored or white flower; state flower of Montana.

Bitterroot Mountains, range of Rocky Mts., along boundary between Idaho and Montana: map I-8

Bitterroot River, Mont., flows north 110 mi. near w. border to join Clark Fork River near Missoula.

Bitter sage S-4

Bittersweet, a vine B-151-2 European B-152, N-145

Bitu'men, any of several substances formed from organic matter by heat and pressure within the earth asphalt A-336-7 petroleum P-145

Bitu'minous coal, soft coal C-284, 286, 288. *See also in Index* Coal carbon cycle, pictograph P-238a

Bituminous Coal Act of 1937 C-288

Bituminous Coal Division, of U.S. Department of Interior U-230, C-288

Bituminous rock, rock asphalt A-337

Bi'valve, mollusk with two-piece shell M-218, S-107. *See also* Clam; Mussel; Oysters; Scallop; Terego

Biwa (*bē-wā*) Lake, a lake of s. Japan having an area of 180 sq. mi.; beautifully situated in Honshu, in region rich in ancient legends.

Bizerte (*bē-zērt'*), or Bezerta (*bē-zēr'tā*), seaport in Tunisia, n. Africa; pop. 26,000; important naval base: map A-42a

Bizet (*bē-zé'*), Georges (1838-75), French musical composer of operas, suites, and symphonies; 'Carmen' most successful of all his works 'Carmen', story O-229-30

Bjerknes (*byēr-k'nēs*), Vilhelm (*vil'hēlm*) (born 1862), Norwegian physicist; professor and researcher

chiefly at the University of Oslo and the Geophysic Institute at Bergen; with his son Jakob (born 1897), developed method of weather forecasting by air mass analysis: W-61-2

Björkman (*byürk'män*), Edwin (August) (born 1866), American critic, born Stockholm, Sweden; came to U. S. 1891; influential in introducing Scandinavian literature to Americans; translated Björnson, Strindberg, Schnitzler ('Gleams: A Fragmentary Interpretation of Man and His World'; 'Voices of Tomorrow'; 'Gates of Life', novel).

Björnson, Björnstjerne (*byēr-nst'yēr-nä byēr'n'sön*) (1832-1910), Norwegian novelist and dramatist B-152

Black, Davidson (1884-1934), Canadian anatomist M-45

Black, Hugh (born 1868), Scottish-American clergyman and writer, born Rothesay, Scotland; minister several Scottish churches; prof. practical theology, Union Theological Seminary, New York City ('The Dream of Youth'; 'Friendship'; 'Culture and Restraint'; 'Lest We Forget').

Black, Hugo La Fayette (born 1886), jurist born Harlan, Ala.; U.S. senator 1927-39; appointed associate justice U.S. Supreme Court 1937, by President Roosevelt.

Black, Joseph (1728-99), Scottish chemist and physicist, discoverer of carbon dioxide; defined latent and specific heat.

Black, William (1841-98), Scottish novelist ('Strange Adventures of a Phaeton'; 'A Princess of Thule').

Black, a "color" C-308b, d, L-129-30 color printing, color plate C-308i paints P-32 produces shade in color C-308d, chart C-308c

Black alder, a tree (*Alnus glutinosa*) of the birch family; has oval, saw-toothed leaves and small conelike fruit; native to Eurasia.

Black and Tans, nickname of Royal Irish Constabulary, formerly the military police of Ireland in Irish rebellion I-129

Black-and-tan setter D-83

Black-and-tan terrier D-82

Black and white warbler W-7

Black angel, an American food fish (*Pomacanthus arcuatus*) from 18 to 24 inches long; the young are black crossed by yellow bands, which disappear later.

Black ant A-211, 213 nest, picture A-212

Black ash, chemical mixture S-190

Black ash, tree (*Fraxinus nigra*) of olive family, found in lowlands from Newfoundland to Kentucky. Grows to 75 ft.; leaves, to 5 in. long, have 7 to 11 leaflets. Wood dark brown, with a fine grain in heartwood; sapwood white; medium strong and stiff; used for furniture, veneer, tool handles, motor vehicles, and sporting goods. Sometimes called brown ash, hoop ash, basket ash, swamp ash, water ash; wood sold as "ash" or "brown ash": A-323

Black-backed gull, picture G-187

"Blackball" B-31

Black basalt ware P-332

Black bass B-63

Black bear B-68, pictures B-67, 68

Blackbeard, name given to Edward Teach, Anglo-American pirate (died 1718) P-222

Black-bellied plover P-259

Black belt, in Alabama A-97, picture A-98a

Blackberry B-152

Black-billed cuckoo C-413

Black birch B-119

Blackbird B-152-3 length of life, pictograph A-198 red-winged B-152, 153, color plate B-137: hatching period B-128 rusty B-130 starling S-277-8, color plate B-137

Blackbirding, in history of slavery, the practise, once prevalent in western Pacific regions, of luring island natives aboard a ship, kidnapping them, and transporting them to forced labor in distant plantations. Sometimes the kidnapped people were paid nominal wages and were permitted to return home later; sometimes they were sold into outright slavery. Ships and men engaged in this business were called "blackbirders." Entire islands were depopulated by them.

Black bread, made from rye R-202

Blackbuck, antelope, pictures A-219

Black'burn, England, cotton manufacturing city in Lancashire, 24 mi. n.w. of Manchester; pop. 123,000; birthplace of Hargreaves, inventor of spinning jenny: map E-270a

Black Butte, in Bad Lands of s.w. N. D., highest point in state, 3468 ft.

Black Canyon, of Colorado River D-6b

Black Canyon of the Gunnison, national monument in Colo. N-20

Black cherry, wild (*Prunus serotina*), large tree with dark brown, bitter, aromatic bark; oblong leaves; small fruit, purple-black, bitter, ripening in late summer; leaves, flowers, and seed are poisonous, containing the glucoside amygdalin from which hydrocyanic acid is formed; grown from Nova Scotia to Dakota, s. to Florida and Texas; wood used for cabinet work.

Black cottonwood, or western balsam poplar, tree (*Populus trichocarpa*) of willow family, native from Alaska to s. California. Grows 40 ft. to 180 ft. Leaves to 5 in. long, whitish or rusty on underside. Lives to 150 yrs. Wood is grayish-white; used chiefly for boxes, and sold as "cottonwood."

Black Country, coal-mining and manufacturing district in Midlands of England between Birmingham and Wolverhampton B-278

Black currant C-414

Black Current. *See in Index* Japan Current

Black Death, or bubonic plague B-153. *See also in Index* Bubonic plague

Black diamonds, or carbonadoes D-60 Brazil B-226a

Black duck, picture D-117

Black Eagle, Order of the, highest order of chivalry in Prussia; founded 1701 by Frederick I; membership restricted to royalty and high officers of state; only members of Order of the Red Eagle were eligible; abolished 1919 with establishment of German Republic.

Black earth belt, in Russia R-180

Black-eye bean B-65

Black-eyed Susan, a yellow daisy D-5

Black-eyed Susan vine. *See in Index* Thunbergia

Blackfeet, or Blackfoot, tribe of Plains Indians of Algonquian stock, formerly living about headwaters of Missouri River and n. to Saskatchewan River I-53 pictures I-57, 60, 62

Blackfeet Sioux, a tribe of the Teton

- Sioux Indians living chiefly in South Dakota; some in North Dakota; distinct from the Algonquian Blackfeet.
- Blackfellows**, of Australia A-367, 372, pictures A-368, M-31
- boomerang B-192, picture B-193
- racial affinity, diagram R-9b
- Blackfish**, or pilot whale, a member of the dolphin family W-77, 80
- Blackfish**, Alaskan, a mudfish M-297
- Black fly**, biting fly of the family *Simuliidae*; also called buffalo gnat and turkey gnat; larvae live in swift streams.
- Blackfoot Indians**. See **Blackfeet**
- Black Forest**, region in s.w. Germany B-153-4, map G-66
- compared to Vosges V-336
- peasant's cottage, picture G-65
- Black fox** F-165
- Black Friars**, or Dominicans M-234
- Inquisition I-80
- Blackfriars Theater**, 16th-century playhouse in London T-76, S-96
- Black frost** F-210
- Black ginger** G-88
- Black Growler Steam Vent**, Yellowstone National Park, picture N-17
- Black gum**, tree (*Nyssa sylvatica*) of the tupelo family, native from Maine to Florida and Texas. Has rounded, narrow crown, deeply fissured bark, branches slightly drooping at ends. Leaves oval, to 4 in. long, glossy green on upper surface, brilliant red and purple in fall. Fruit oval, dark blue, small, 1 to 3 in. cluster. Sometimes called pepperidge, sour gum, tupelo, and black tupelo: G-188, pictures T-132, 134, 135
- Black haw**, a tall shrub or small tree (*Viburnum prunifolium*) of the honeysuckle family with stout spreading branches; flowers white; fruit, a small sweet blue-black oval drupe; an ornamental shrub.
- Black Hawk** (1767-1838), Sauk Indian chief; warred against Osage and Cherokee Indians; organized other tribes to attack settlers in Illinois; precipitated Black Hawk War; died near Fort Des Moines; statue at Oregon, Ill.: I-68
- Black Hawk War** I-68
- Jefferson Davis D-19
- Lincoln L-140
- Taylor T-20
- Blackhead**, in skin S-157
- Black-headed grosbeak** G-179, color plate B-138
- Black-headed gull**, or laughing gull G-186, pictures G-187
- Blackheath**, open common in s.e. London, England; scene of many historic gatherings; rallying place of Wat Tyler and Jack Cade.
- Black hellebore**. See in *Index* Christmas rose
- Black helmet**, shell S-108
- Black Hills**, in South Dakota and Wyoming (Harney Peak 7242 ft.); gold, lead, silver; named from dense pine forests: S-217-18, map S-218
- Devils Tower N-22, picture W-193
- minerals S-218-19
- Mt. Rushmore Memorial S-217: site, picture S-220
- Needles, picture S-219
- Wind Cave National Park N-22e
- "Black Hole," of Calcutta C-21
- Blackie**, John Stuart (1809-95), Scottish philologist; professor at Marischal College, Aberdeen, and at Edinburgh University; wrote on philological, moral, and literary subjects and composed some verse ('Life of Burns'; translations of 'Faust', dramas of Aeschylus, 'The Iliad').
- Blacking**, a preparation for polishing black shoes, harness leathers, etc.; usually contains lampblack, sugar, grease, and calcium sulphate.
- Blackjack oak**, tree (*Quercus marilandica*) of beech family, native from New York to Nebraska and southward. Grows to 50 ft.; leaves to 8 in. long, broad at tip with shallow lobes, and white on underside. Scales on cup holding acorn curve backward.
- Black Jack pine**. See in *Index* Lodge pole pine
- Black Kettle** (1803?-68), Cheyenne Indian chief; offered friendship to whites, who betrayed him; his village at Sand Creek, Colorado, attacked by militia; killed in massacre by Custer's forces in Washita Valley near Fort Cobb.
- Black Kirghiz**, or Kara Kirghiz, so-called from color of their tents; Mongolian people inhabiting highlands of central Asia.
- Black lead**. See in *Index* Graphite
- Blackleg**, disease of cattle C-106
- vaccination against, picture C-114
- Black letter**, style of type B-177
- Black-line engraving** E-294
- Blacklist**, in labor L-44c
- Black locust**, a tree L-179
- Black magic** M-32
- Black maple**, a sugar maple M-56
- Black market**, an illegal market where rationed or forbidden goods are bought and sold at high profits, particularly in wartime: N-12p
- Black marten**, fisher, or pekan M-72
- Black Monks**. See in *Index* Benedictines
- Blackmore**, Richard Doddridge (1825-1900), English novelist; born Longworth, Berkshire; practised law until health failed; fame rests upon romantic novel 'Lorna Doone', now a classic.
- Black Mountain College**, near Black Mountain, N.C., founded 1933; co-educational; courses in arts and sciences comparable to usual collegiate work, but no degrees granted; progressive and experimental; emphasizes community living, individual responsibility.
- Black Mountains**, spur of the Blue Ridge Mountains of s. Appalachians A-230
- Black mulberry** M-298
- Black-necked stork**, picture S-296
- Black opal** G-29
- Blackout** N-12m
- Black pepper** P-119, picture S-251
- Blackpool**, England, popular watering place on Irish Sea, 30 mi. n. of Liverpool; pop. 102,000.
- Black powder**, or gunpowder G-188-9
- Black Prince** H-357, 358. See also in *Index* Edward, Prince of Wales
- Black race** R-10, Outline R-12
- numbers P-304d
- Black rat** R-51, 52
- Black River**, N. Y., rises in e. cent. part of state and flows n.w. through Watertown into Lake Ontario; about 200 mi.; furnishes water power to Watertown and surrounding villages: map N-114
- Black River**, Wis., tributary of Mississippi, about 200 mi. long, map W-124
- Black Rock Desert**, Nev. U-182, map N-77
- Black Sea**, between s.e. Europe and Asia Minor B-154, maps B-154, E-326e. See also in *Index* Ocean, table
- Russian ports B-154, P-143: canals connect with Volga V-334
- Black Sea wheat**, in U. S. A-53
- "Blackshirts," Fascists in Italy F-18, picture I-159
- Blacksnake** S-172
- Black spotted trout** T-145
- Black spruce** S-264
- Black stem rust** R-199
- Blackstone**, Sir William (1723-80). English jurist; wrote 'Commentaries on the Laws of England', the best-known treatise on English law, and the foundation of legal training in England and U.S.
- Blackstone River**, rises in Mass., crosses n.e. R. I. and enters Providence River near Providence; length 75 mi.; called Seekonk or "Pawtucket" in its lower course.
- Black swan** S-334
- Black-tailed deer** D-36-7
- Black tea** T-26, 27
- preparation, picture T-26
- Blackthorn**. See in *Index* Sloe
- Black-throated blue warbler**, picture W-7
- Black-throated bunting** B-273
- Black tupelo** (*Lq'pē-lō*). See in *Index* Black gum
- Black vulture**, also called black buzzard V-336, B-288
- Black walnut** W-5, 6, picture W-6
- Black Warrior River**, in w. cent. Ala.; flows s.w. into Tombigbee River; navigable from Demopolis to Tuscaloosa: A-98d, map A-98
- Blackwater River**, Ireland, chiefly in Cork county; flows e. and s. 100 mi. to sea at Youghal Bay.
- Blackwell**, Alice Stone (born 1857) journalist, born East Orange, N. J.; editor of *Woman's Journal* 1893-1917
- suffrage work W-132
- Blackwell**, Elizabeth (1821-1910), first woman medical graduate in U. S.; founded infirmary for Women and Children and with her sister, Dr. Emily Blackwell (1826-1910), *Woman's Medical College* of New York infirmary.
- Blackwells Island**. See in *Index* Welfare Island
- Black whirligig**, a water beetle, family *Gyrinidae*, picture W-46
- Black widow spider** S-257
- Black willow** W-104b, W-105
- Blackwood**, Algernon (born 1869). British novelist; especially successful in tales of fantasy and horror; polished style ('The Centaur'; 'A Prisoner in Fairyland').
- Blackwood**, Frederick Temple. See in *Index* Dufferin and Ava, Marquis of
- Blackwood**, an acacia A-4
- Black work**, or niello (*nī-ē'lō*), in decorating metals E-294
- Bladder** K-16
- Bladder worm**, larval tapeworm W-180a
- Bladderwort**, an insect-eating plant P-243, picture P-242
- Bladensburg**, Md., small town 6 mi. e. of Washington; pop. 1220; U. S. troops defeated by British August, 1814; once noted dueling ground.
- Blaine**, James Gillespie (1830-93), American statesman B-155, picture H-230
- Bering Sea controversy H-230, S-70
- Clayton-Bulwer treaty and A-314
- Cleveland and C-266
- Harrison and H-227, 228, 230-1
- Pan American movement L-67o
- peace efforts P-91, H-230

ü=French u, German ü; gem, ðo; thin, then; ñ=French nasal (Jean); zh=French j (z in azure); K=German guttural ch

Blaine resolution, on prohibition repeal P-350

Blair, Andrew George (1844-1907), Canadian statesman, born Fredericton, New Brunswick, Canada; prime minister of New Brunswick 1883-96; minister of railways and canals for Canada 1896-1903.

Blair, Francis Preston (1791-1876), American journalist, friend of Jackson and Van Buren, active supporter of Lincoln; father of Francis P., Jr., and Montgomery

aids Union cause C-253

Blair, Francis P., Jr. (1821-75), American journalist and soldier, prominent in Missouri politics; helped save state to Union; major general Union army; U. S. senator 1871-73.

Blair, John (1732-1800), American jurist, born Williamsburg, Va.; member of Federal Constitutional Convention, and one of seven Virginians to sign; associate justice of U. S. Supreme Court 1789-96.

Blair, Montgomery (1813-83), American lawyer, born Franklin County, Ky.; postmaster general in Lincoln's cabinet: picture L-143

Blaise (blāz), Saint (also Blaise, Blasius, Blase), Bishop of Sebaste in Asia Minor; martyred 320 A.D.; cured a boy choking from fishbone and became patron saint against all diseases of throat; blessing of St. Blaise given annually in Catholic churches, two crossed candles being held under chin; feast day Feb. 3.

Blake, Edward (1833-1912), Canadian statesman, premier of Ontario 1871-72, Dominion cabinet member and later Home Rule member of British Parliament.

Blake, Lyman (1835-93), American inventor, born South Abington, Mass.; designed the modern machine-sewed shoe and machinery to make it: S-131

Blake, Robert (1599-1657), English admiral B-155, picture E-271

Blake, William (1757-1827), English poet, artist, and mystic B-155 children's literature, place in L-160 poetic view of life, quoted on P-271 'The Tiger' quoted T-92

Blakelock, Ralph A. (1847-1919), American landscape painter, born New York City; neglected and insane for 20 years before death ('The Pipe Dance'): P-29

Blakeslee, Albert Francis (born 1874), American botanist, born Geneseo, N.Y.; director since 1936, Carnegie Station for Experimental Evolution, Cold Spring Harbor, N.Y. colchicine experiments P-245f

Blakesley, Thomas H. (1847-1929), English scientist; civil engineer; improved methods of measuring properties of optical instruments; devised new lenses and spectroscopes; invented portable mercurial barometer.

Blakistone Island, an island in the Potomac River; landing place (Mar. 25, 1634) of first settlers sent out by Lord Baltimore; originally named St. Clement's Island.

Blamey, Sir Thomas Albert (born 1884), Australian army officer; made commander of all Ground Forces of United Nations in s.w. Pacific, under General MacArthur, March 1942.

Blanc (blān), Jean Joseph Louis (1811-82), French socialist, at height of fame 1848-49; pioneer of "political," or "government-ownership," socialism, chief outcome of which was gradual adoption in many lands of government

ownership of railroads, telegraphs, telephones, water works.

Blanc, Paul Joseph (1846-1904), French mural painter

'Baptism of Clovis', picture M-159

Blanc, Cape, Tunisia, northernmost tip of Africa.

Blanc, Mont ("white mountain"), highest peak of Alps (15,782 ft.), second highest in Europe; 7 mi. inside French boundary: map F-179, picture G-29

Blanca Peak, in s. Colo. (14,310 ft.); highest peak of beautiful Sangre de Cristo range.

Blanchard (blān-shār'), Jean Pierre (1753-1809), French aeronaut, first to cross Channel in balloon.

Blanche of Castile (1188-1252), Spanish princess, queen of Louis VIII of France; regent during minority of Louis IX: L-200

Blanchet, François N. (1795-1883), French Catholic missionary; labored among trappers and Indians of Oregon; first archbishop of Oregon City.

Blanching, of celery C-121

Blanco (blāng'kō), Antonio Guzman (1829-99), Venezuelan dictator (1870-90); made self president by revolution 1870; promoted education and improved economic life.

Blan'cos ("Whites"), political party of Uruguay U-263

Bland, Edith Nesbit (1858-1924), English author of children's books, born London; wrote stories of the Bastable children, based on episodes in her own childhood; delightful combination of humor and imagination ('Treasure Seekers'; 'Five Children and It'; 'Story of the Amulet'; 'The Wouldbegoods').

Bland, Henry Meade (1863-1931), American poet, born Fairfield, Solano County, Calif.; chosen poet laureate of California 1929; professor English, state college at San Jose; ('Sierran Pan'; 'The Tavern'; 'A Song of Autumn').

Bland, James A. (1855?-1911), American Negro minstrel and songwriter, born Flushing, L.I.; wrote words and music for more than 500 songs ('Carry Me Back to Old Virginia'; 'In the Evening by the Moonlight'; 'Oh, Dem Golden Slippers').

Bland, Richard Parks (1835-99), born near Hartford, Ky.; member House of Representatives 1872-95, 1897-99; leader of Free Silver movement; author of Bland-Allison Act.

Bland-Allison Act H-252

Blanket-flower. See in Index Gaillardia

Blank indorsement, of check C-393

Blank verse P-269

Shakespeare's S-100b, d-e, P-269

Blanshard, Richard (1817?-1894), first Canadian governor of Vancouver Island (1849-51); born England.

Blantyre (blān-tīr'), Nyasaland, Africa, commercial center and missionary headquarters; pop. 6000: maps E-139, A-42a

Blarney, village in Ireland, 5 mi. n.w. of Cork; castle contains Blarney Stone

castle C-366, picture I-127

Blasco Ibañez (ē-bān'yāth), Vicente (1867-1928), Spanish novelist I-1, V-269, picture S-237

Blase, Saint. See in Index Blaise

Bläser (blē'zēr), Gustav (1813-74), German sculptor; outstanding of period in Germany; many commis-

sions for Frederick II ('Warrior under the Protection of Minerva').

Blash'field, Edwin Howland (1848-1936), American mural painter, born New York City, studied in Paris; noted for idealized and symbolic figures, soft coloring, skilful composition ('Development of Civilization' in Library of Congress; paintings in Youngstown, Ohio, Baltimore, Md., and Newark, N. J., courthouses and in state capitols of Minn., Iowa, Wis., S. D.); also known as writer and lecturer on art 'Westward', picture U-233

Blasius, Saint. See in Index Blaise

Blast furnace, for smelting iron I-138, pictures I-135, 136-7

Blast-furnace gas G-23 use in gas engines G-19

Blasting

coal mining M-188

explosives in E-348

rock, picture C-126

Blasting gelatine, an explosive derived from cellulose nitrate, chart C-123

invented by Nobel D-122

Blavat'sky, Helena Petrovna (1831-91), Russian theosophist; founded Theosophical Society (1875); wrote 'Isis Unveiled'; 'The Secret Doctrine'; 'The Key to Theosophy'; 'Theosophical Glossary'.

Blazing the trails, in colonial America T-124

Blazing star. See in Index Liatris

Bleaching, of fabrics B-155 chlorine used B-155, C-223

Bleak (blēk), a small, silvery, European fish of the carp family artificial pearls from scales P-97

'Bleak House', novel by Dickens; plot built upon lengthy lawsuit of Jarndyce vs. Jarndyce which was in court almost 50 years: D-66

Bleeding

clotting of blood B-157-8

how to check: first aid F-62-3

vitamin deficiency causes V-311a

Bleeding-heart, a perennial garden herb (*Dicentra spectabilis*) with long racemes of drooping heart-shaped rose-red flowers, introduced from Japan.

Blefuscu'dians, in 'Gulliver's Travels' enemies of Lilliputians.

Blende, a sulphide of zinc Z-217

crystal, picture C-409

Blenheim (blēn'im, German blēn'hīm), Germany, Bavarian village on Danube, 23 mi. n.w. of Augsburg battle of M-66

Blennerhas'sett, Harman (1765-1831), wealthy English lawyer; married niece and was ostracised by family and friends; removed to U. S. 1796 and established magnificent estate on island known by his name in Ohio River; became involved in Aaron Burr's conspiracy and was ruined.

Blennerhassett Island O-215

Blenny, one of a genus (*Blennius*) of small spiny-rayed fishes, whose skin is covered with slimy matter; frequents shallows along coasts, moving about among rocks and seaweeds: picture F-67, color plate F-72a-b

Bleriot (blē-rē-d'), Louis (1872-1936), French pioneer in aviation, born Cambrai; studied engineering and began experimenting with flying machines in 1900; earliest successful flight in plane of his own design 1907; first flier to cross English Channel July 25, 1909 monoplane, pictures A-66, 70

Bles'bok, an African antelope closely related to the hartebeest.

'Blessed Damosel, The', a poem by Dante Gabriel Rossetti describing the yearning of a young girl in heaven for her lover on earth. Rossetti also painted this subject.

Blicher (*blik'er*). Steen Steensen (1782-1848), Danish lyric poet, short-story writer, and novelist; translated Ossian's poems ('The Knitting-Room', dialect poems and stories; 'Old and New Tales', containing humorous autobiography).

Blickensderfer typewriter T-175

Blicking Homilies, facsimile, picture B-188

Bligh (*bli*), William (1754-1817), English admiral; with Capt. James Cook on his second expedition; discovered breadfruit tree; sent to Pacific in command of *Bounty* to fetch tree and introduce it into West Indies; part of crew mutinied, setting Bligh and 20 men to drift nearly 4000 mi. in open boat before landing at Timor; became governor of New South Wales.

Blights, various plant diseases B-156. See also in Index Plant diseases

chestnut C-338, F-156
pear-leaf P-95

"Blighly," slang term meaning home; used by British soldiers during 1st World War.

Blimp, non-rigid dirigible B-24
sea patrol in wartime B-31

Blind, education of B-156-7
Helen Keller K-10

Blind fish, of Mammoth Cave C-117

Blind flying A-76, 78, pictures A-77

Blind man's buff, game, picture K-18

Blind spot, in human eye E-350, diagram E-349

Blind stamping, stamping without gilding, in bookbinding B-183

Blind-worm, slow-worm, or glass-snake, a legless lizard L-171, picture L-170

Bliss, Arthur (born 1891), English composer; works show freshness and independence, and include orchestral compositions ('Colour Symphony'; 'Mélée Fantastique'), piano pieces, songs.

Bliss, Philip Paul (1838-76), singing evangelist and writer of gospel songs, born Clearfield County, Pa.; taught music; became evangelist in 1874 ('The Charm'; 'The Sunshine').

Bliss, Tasker Howard (1853-1930), American army officer, born Lewisburg, Pa.; served in Spanish-American War; became chief of staff U. S. Army, with rank of general 1917; member Supreme War Council in France and American peace commission 1918-19.

Bliss-Leavitt torpedo T-114

Blister, on battleship N-55

Blister, skin, treatment of F-66

Blister-beetle, or Spanish fly B-84, picture B-81

potato pest P-326

scientific name B-85

Blister copper C-360

Blister-ore. See in Index Erysimum

Blister pearl P-97

Blister rust, white pine R-199, picture R-200

Blitzkrieg (*blits'krēg*), or "lightning war" W-178d

Blitzstein (*blits'stin*), Marc (born 1905), American composer, born Philadelphia; influenced by Schönberg and other modernists, developed vigorous and original style

('The Cradle Will Rock', musical play; 'Percussion Music').

Blizzard W-113

Bloater, a type of smoked herring, salted and smoked only long enough to dry the fish but not to cure it.

Bloc, a combination of political parties or of members of different parties united in behalf of some special cause, as "peace bloc," "farm bloc," "labor bloc."

Bloch (*blök*), Ernest (born 1880), American composer, born Geneva, Switzerland; came to U. S. 1916; became director San Francisco Conservatory 1925; many compositions Jewish in spirit; epic rhapsody 'America' fused patriotic, religious, and popular American themes, Indian and Negro folk melodies.

Bloch (*blök*), Jean Richard (born 1884), French novelist and dramatist F-199

Block, Adriaen, Dutch navigator who explored Long Island and discovered Housatonic and Connecticut rivers in 1614; Block Island named for him; first to map s. coast of New England in detail.

Blockade B-157

Civil War in America B-157, C-256
"continental system" of Napoleon N-10, W-8, C-323
embargo acts E-258

1st World War W-158-9, R-188, E-258, B-157

legal aspects I-109-10

"long-range" B-157

mine T-114-15

pacific blockade B-157

2d World War B-157, W-178e, f, k-l

Block and tackle M-105

log loaders, pictures L-214, 215

Block captain, in civilian defense N-12m

Blockhouse, a stronghold, built usually in two stories of heavy logs banked with earth with loopholes for musketry in sides; used in wars with American Indians, and in Spanish-American and Boer wars: picture W-28b

Blocking, in boxing B-208

Block Island, R. I.; a small island in the Atlantic Ocean, lying 10 mi. from the shore of Rhode Island to which it belongs; named from Adriaen Block who reached there in 1614; popular as a summer resort: maps R-97, L-195

Block Island Sound, body of water between Block Island and Long Island.

Block printing B-180, P-346

dyeing method D-122

Japanese J-202, color plates J-196a-b, J-202a-b

playing cards C-83

wall paper W-4

wood engraving E-294

Block system, on railroads R-44

Block tin, pure tin T-98

Bloemfontein (*blum'fōn-tān*), cap. of Orange Free State, Union of South Africa; captured in Boer War; pop. 65,000 (including 30,000 Europeans): maps S-202, A-42a

Blois (*blwä*), France, historic town on Loire, 100 mi. s.w. of Paris; pop. 26,000; splendid castle, once seat of powerful counts of Blois; trade and manufacturing center: map F-179

Block (*blök*), Alexander (1880-1921).

Russian poet R-197

chief works, list R-198

Block, Petrus J. (born 1855), Dutch historian; professor Dutch history, University of Leyden ('History of

the Dutch People'; 'A Dutch Town in the Middle Ages').

Blonde lace L-48

Blondel de Nesle (*blōn-dēl dū nēl'*), French minstrel, friend and attendant of Richard I R-104

Blon'din, Charles (1824-97), French acrobat; real name was Jean François Gravelet

crosses Niagara on tight rope N-138

Blood, Thomas (1618?-80), called "Colonel," notorious Irish adventurer L-184

Blood B-157-8

acidity and alkalinity, measuring A-10

albumen in A-111

antiseptics ("sulfa" drugs) A-222-3
arterial and venous B-157a

chemistry B-158

chromates poison C-231

circulation B-158, H-257-9, pictograph H-258a, pictures P-204-5, H-258

clotting, or coagulation B-157b: vitamin K promotes V-311a

commercial uses M-97

corpuscles B-157-57a, 157b-58, picture G-79: manufactured by bone

marrow B-157a

count B-157b-58

disease germs in G-78-80, picture M-269: antitoxins and serums A-223-4; white corpuscles destroy B-157a

emotion affects E-262

fibrinogen B-157b

food builders F-145

hemoglobin B-157a, B-110

iron I-134, B-157a

lymph. See in Index Lymph

oxygen carried by red cells B-157a, B-110

plasma B-157, 157a-b, P-206: in blood transfusion B-158, picture B-157b

platelets B-157, 157a

pressure B-158

pulse P-365

race classification R-10

serum B-157b

sugar G-107

temperature B-157b: warm-blooded and cold-blooded animals B-121. M-44

tests B-157b-58: centrifuge device C-134

transfusion B-158, picture B-157b

types B-158

withdrawn from brain in sleep S-163

"Blood and iron," Bismarck's policy B-147

Blood bank, a place where blood is stored for future use B-158

Blood count B-157b-58

Bloodhound D-79, 82, picture D-81

Blood orange, or Maltese orange O-240

Blood-poisoning A-222, 224

Blood pressure B-158

emotion affects E-262

Blood purge

Germany G-76a

Russia: Moscow trials R-194b

Bloodroot, herb B-158-9

bulblike root B-269

Bloodstone, or heliotrope, a semi-precious stone G-28

March birthday stone G-25

Blood tests B-157b-58

Blood transfusion B-158, picture B-157b

Blood vessels. See in Index Arteries; Capillary; Veins

Bloody Assizes J-183

"Bloody Mary," epithet applied to Mary I, Queen of England M-73

Bloomer, (Mrs.) Amelia Jenks (1818-94), American dress reformer and temperance lecturer; gave name to "bloomers."

Bloomfield, N. J., manufacturing town adjoining Newark; pop. 41,623; Bloomfield College and Theological Seminary.

Bloomfield Zeisler, Fannie (1866-1927), American concert pianist, born in Austrian Silesia; one of foremost women musicians.

Blooming mill, *picture* I-140

Bloomington, Ill., city 57 mi. n.e. of Springfield in corn belt; pop. 32,868; railroad shops, stove and furnace manufactures; Illinois Wesleyan University; *map* I-13

Bloomington, Ind., city 46 mi. s.w. of Indianapolis; pop. 20,870; vast quarries of Bedford limestone, furniture factories; seat of state university; *map* I-46

university building, *picture* I-49

'Blot on the 'Scutcheon', tragedy by Browning B-252

Blotting paper, why it absorbs ink C-81

Blouet (*blô-e'*), Paul. *See in Index* O'Rell, Max

Blougram, Bishop, in Browning's 'Bishop Blougram's Apology', skeptical, worldly churchman.

Blount, William (1749-1800), American politician, born Bertie County, N. C.; in 1790 appointed governor of the "Territory South of the River Ohio" by President Washington and made his headquarters in Tennessee; elected to U. S. Senate from Tenn.; expelled from Senate because of his part in conspiracy to seize Spanish territory in America for England. His was first impeachment trial ever brought before U. S. Senate.

Blow-fly. *See in Index* Flesh fly

Blow-gun. *See in Index* Blowpipe

Blowing machines, devices for producing currents of air. *See also in Index* Pneumatic appliances

bellows of pipe organ O-248, 250, *picture* O-249

ventilating device M-188

Blowpipe, or blow-gun, a tube of wood or bamboo for blowing darts; used for hunting birds and small animals, by Indians of s. U.S. and South America, and by natives of East Indies; the darts are sometimes poisoned for use on big game or human enemies

Borneo, *picture* B-197

South America S-206, *picture* L-67e

Blowpipe, oxyhydrogen H-368

Blubber, layer of fat beneath skin in certain animals

seal E-302

whale W-78, *picture* W-80

Blücher (*blü'kēr*), Gebhard Leberecht von (1742-1819), Prussian field marshal, leader of patriot Prussian party during Napoleonic period at Waterloo W-48

Blue, color

eye reaction C-308j

how perceived L-129

intensity, hue, value C-308d, *chart* C-308c

mixtures C-308b, f-i

place in spectrum, *picture* C-308a

primary color C-308b, *color charts* C-308b, c, h

produced by cobalt C-290

produced by copper F-60, P-330

sky, why blue A-62

symbolism C-308j

wave-length S-242

Blue Andalusian, a breed of fowls

P-338, *picture* P-337

Blue and white, Chinese porcelain

P-330

Blue ash A-323

Blueback salmon S-13

Bluebeard, villain in French fairy tale ('*Barbe-bleue*'), by Perrault; his wife disregards command not to open a certain door, and discovers bodies of his murdered former wives; she is rescued just in time from sharing their fate; similar stories exist in folk-lore of other countries.

Blue beech. *See in Index* Hornbeam

Bluebell, a campanula B-159

how to plant G-10

Blueberry B-159

Bluebird B-159

belongs to thrush family T-88

houses B-142, *pictures* B-143

migrations M-163

young, color B-132

'Blue Bird, The', fairy play by Maurice Maeterlinck, first produced in Belgium in 1909 M-24

Blue Birds, junior organization of Camp Fire Girls C-41

Bluebonnet, a dark blue flower of the lupine genus (*Lupinus subcar-nosus*); state flower of Texas; leaves digitate; five-petaled flowers in terminal racemes.

Blue butterfly, a small azure butterfly of the family *Lycaenidae* eggs, *picture* E-193

Bluecoat school, nickname for Christ's Hospital, school in London; students wear long blue coats: L-56

Blue columbine, Colorado state flower C-316

Blue crab C-390

Blue daisy, a common name for the heteropappus and for one species of felicia. *See in Index* Felicia; Heteropappus

Blue darter, or Cooper's hawk H-245, *pictures* H-246, B-123

beak, *color plate* B-130

Blue Diamond d'Angleterre, famous diamond, *picture* D-63

Blue-eyed African daisy. *See in Index* Arctotis

Blue-eyed Mary. *See in Index* Collinsia

Bluefield, town on Va. and W. Va. border, w. of Roanoke; distributing center for Pocahontas coal fields; pop. in W. Va. 20,641, in Va. 3921; railroad shops, flour mills, wood-working plants, machine shops; state teachers college for Negroes: *map* W-76

Bluefields, Nicaragua, port on e. coast; pop. 7000; wireless station; has often been center of revolutionary activities: N-141, *map* C-132

Bluefin, a tunalike fish T-155

Blue fir. *See in Index* White fir

Bluefish F-74

Blue flag, a species of iris I-130

Blue fox F-165

Bluegill, fresh-water fish (*Helio-perca incisor*), member of the sunfish (*Centrarchidae*) family; named from bluish color of cheeks and gill covers; general color greenish; good food fish, abundant in most parts of the United States.

Bluegrass, any of various species of the genus *Poa*, especially the Kentucky bluegrass; it has many running rootstocks which form a dense sod, and grows from a few inches to two feet high; grows especially well in limestone regions of Kentucky and Tennessee

lawn planting G-9

Bluegrass State, popular name for Kentucky.

Blue grosbeak G-179

Blue gum, a eucalyptus E-315, T-14

Blue hare H-223

Blue hawk, or haggard, a falcon F-7

Blue Hen State, popular name for Delaware D-42

Blue heron S-296-7, *pictures* S-296, *color plate* B-134

Blue Island, Ill., manufacturing and commercial city just s. of Chicago city limits; pop. 16,638.

Bluejay B-160

Blue lace flower. *See in Index* Trachymene

Blue Laws, any laws designed to regulate the ordinary habits or morals of individuals; particularly, in Connecticut, the strict laws of Puritan days: U-235

Delaware D-41

Blue lead, a basic lead sulphate mixed with small quantities of lead sulphide, lead sulphite, zinc oxide, and carbon; a by-product of lead smelting; color varies from gray to white; used as a paint coloring.

Blue litmus test L-165

Blue lodge, Freemason F-193

Blue magpie F-160

Blue Mountain, in Arkansas. *See in Index* Magazine Mountain

Blue Mountains, Australia, part of Great Dividing Range, *picture* N-103

Blue Mountains, Ore., in n.e.; 8000 to 9000 ft. high; heavily wooded: *map* O-246

Blue Mountains (also Kittatinny and North), Pa. P-112, *map* P-112

Blue mud-dauber, a wasp, *color plate* W-32a-b

Blue Network, in radio R-30

Blue Nile River, or Abbat River, in Africa, rises in Italian East Africa; unites with White Nile near Khartum: N-145-6, E-308, *map* A-42a

Blue Peter, rectangular blue flag with rectangular white center; when hoisted alone at top of foremast signifies ship is ready to sail.

Blue Point, oyster center on Long Island L-195, *map* L-195

Blue-point oyster, oyster suitable for eating raw; found near Blue Point, Long Island; term now used for any oyster of same type.

Blue print P-186

Blue racer, snake S-172

Blue Ridge Mountains, southeasternmost range of Appalachian Mts. A-230, *maps* U-188c, V-306, N-156

Maryland M-76

Shenandoah National Park N-22d, *picture* V-308a

Virginia V-303-4

Blue Ridge Parkway N-22e-f

Blue rorqual, blue whale, or sulphur-bottom W-80, *picture* W-79

Blue sage, several perennial plants of the sage family; members of the genus *Salvia*. Flowers are soft blue to azure blue, small, and grow in whorls on slender spikes.

Blue shark, *picture* S-103

Blue sheep, or burriel S-105

Blue Sky Laws S-292

Blue spruce, or Colorado spruce S-264

Bluestocking, term applied to a literary woman; originated in 18th century when a guest at an exclusive literary gathering in London wore blue stockings.

Bluestone C-176b

Bluet, a small wild flower (*Houstonia caerulea*) of the madder family, with delicate blue, violet, or nearly white flowers with yellow centers. Native from Nova Scotia to Georgia and Missouri.

Key—cāpe, āt, fār, fāst, whāt, fāl; mē, yēt, fērn, thēre; īce, bīt; rōw, wōn, fōr, nōt, dō; cūre, būt, rȳde, fūll, bārñ;

- Blue vitriol, copper sulphate S-324, C-361
- Blue Water International Bridge, over St. Clair River, between Port Huron, Mich., and Sarnia, Ont., table B-342
- Blue-weed. *See in Index* Vipers-bugloss
- Blue whale W-80, picture W-79
- Bluing, indigo, prussian, and coal-tar blues used in laundry water to neutralize the yellow tint of white clothes.
- Blum, Léon (born 1872), French premier 1936-37, first Socialist to head French government; leader of Socialist party; writer and critic; held for trial for "war guilt" 1940: F-182
- Blum, Robert Frederick (1857-1903), American artist, born Cincinnati, Ohio; most noted for easel paintings and murals; also etcher, illustrator ('Moods of Music', mural; 'Venetian Lacemakers', figure painting).
- Blumenbach (blŭ'mĕn-bāk), Johann F. (1752-1840), German naturalist, anthropologist; founded science of anthropology; placed comparative anatomy on scientific basis.
- Blumenschein, Ernest Leonard (born 1874), American artist, born Pittsburgh, Pa.; work shows clear and accurate portrayal of subject and a pleasing use of color; chiefly known for paintings of the Taos Indians of New Mexico.
- Blunderbuss, a gun F-52, 48
- Blunger, vat for mixing clay for pottery P-327
- Blunt, Wilfrid Scawen (1840-1922), English traveler and poet; attached to various British embassies in Europe; took part in Irish freedom movement; wrote emotional verse, often in style of Byron, whose granddaughter he married ('Love Sonnets of Proteus'; 'Esther'; 'Griselda'; 'India Under Ripon'; 'The Land War in Ireland').
- Bly, Nellie. *See in Index* Seaman, Elizabeth Cochrane
- Blythe, Samuel George (born 1868), American journalist and writer, born Geneseo, N.Y.; has been editor and writer for a number of magazines and newspapers; staff writer *Saturday Evening Post* since 1907 ('We Have With Us Tonight'; 'The Revolt of Peter Purdy').
- Blytheville, Ark., city 62 mi. n. of Memphis; pop. 10,652; cotton and lumber products.
- B'nai Brith (bnā brith), Independent Order of, a Jewish fraternal organization founded in New York City in 1843 for the moral improvement of its members and the furtherance of "charity, benevolence, and brotherly love"; has branches throughout the U. S., in Europe, and the Near East; name means "sons of the covenant."
- Boa, a genus of nonvenomous serpents of tropical America, belonging to *Boidae* family; prey killed by crushing in coils; important species, anaconda and boa constrictor: B-160, S-170, S-173, pictures S-171
- Boabdil (bō-āb-dē'l), or Abu Abdullah, last Moorish king of Granada (1482-92); conquered and dethroned by Ferdinand II of Spain: picture S-227
- Boa constrictor B-160, S-170, picture S-171
- Boadicea (bō-ā-dī-sē-ā), or Boudicca (died 62? A.D.), fierce British warrior queen who vainly resisted Romans; burned London in 61 A. D.
- Boake, Barcroft Henry (1866-92), Australian poet ('Where the Dead Men Lie').
- Boanerges (bō-ā-nēr-jēz), "sons of thunder," name given by Jesus to the disciples James and John.
- Boar, mature male hog, also the popular name for various wild hogs, particularly the European and the Indian wild hog: B-160
- Adonis myth A-22
- ancestor of domestic swine H-316
- Boardman, Russell (1898-1933), American aviator, picture A-73
- New York to Istanbul, Turkey, flight, table A-74
- Board of Governors, Federal Reserve system F-22
- Board of Health, or Health Department H-254-7. *See also in Index* Hygiene; Public health
- Board of Trade Building, Chicago, picture C-193
- Board of trustees, of college U-258
- Boards of trade B-160-1
- grain exchange, operation E-151-2
- records U-230
- Boar's head procession, Christmas custom C-227, 229
- Boas, Franz (1858-1942), American anthropologist, born in Germany; explored Baffin Land and made expeditions in Mexico, Puerto Rico, and north Pacific; professor of anthropology at Columbia University 1899-1937; curator of anthropology, American Museum of Natural History (1901-5) ('The Mind of Primitive Man'; 'Anthropology and Modern Life'; 'Race, Language, and Culture').
- Boat B-161-6. *See also in Index* Canoes and canoeing; Navigation; Sailing craft; Shipbuilding; Ships; Steam craft
- American Indian I-62, C-75, 76, B-161-3, 166
- basket boats B-59, B-165, pictures B-162, B-168
- Borneo, picture B-198
- Burma, picture B-278b
- canal boat, picture T-124
- canoes distinguished from B-163
- catamaran B-166, picture B-162
- Chinese C-216, C-79, A-330, pictures C-216, 218, 221, 221d, F-139, S-125
- Coast Guard life-saving boats L-123
- coracle B-165, picture B-162
- early types B-165-6, T-121-2, S-117-18, pictures B-162
- flatboats T-122, P-221e, picture P-221f
- glass-bottomed: Santa Catalina Island L-199
- gondola, pictures B-251, V-278
- goofah B-165, picture B-162
- house-boats: Chinese C-216, C-79, A-330, pictures C-216, F-139; South Seas, picture P-4
- hulls, various types B-164
- junks C-216, pictures C-221d, S-125
- kayak C-76, picture B-162
- motor boats M-291
- rowboats and rowing B-163
- Turkish, picture T-162
- Viking N-166, pictures N-168, S-125
- Boatman, water, a bug W-46
- stridulating disk, picture M-157
- Boat racing
- Chinese Dragon Boat Festival, picture C-221
- college contests B-163: Oxford O-260
- Isle of Wight W-97
- yacht racing B-164
- Boatswain (bō's'n or bōt'swān), subordinate officer of the navy in charge of rigging, anchors, cordage, cables, etc., who summons crew to duty
- insignia, picture U-179
- Bonz (bō'āz), in the Bible, 2d husband of Ruth R-202
- 'Bob, Son of Battle', novel by Alfred Ollivant D-78
- Bobbinet, a machine-made net of cotton or silk yarns partially twisted around one another to form hexagonal meshes; used for dresses, trimmings, draperies, linings.
- Bobbin lace, or pillow lace L-47, picture L-49
- 'Bobby,' nickname for London policeman P-287, picture P-289
- Bobcat, the American lynx L-223
- Bob'olink, or rice bird B-166, color plate B-138
- migration M-163, B-166
- seasonal plumage change F-20, B-166
- Bobrovka, or green garnet, a semi-precious stone G-28
- Bob-sleds W-118
- Bob-white, North American quail Q-1, pictures Q-1, color plate B-134
- feeding habits B-122
- Boccaccio (bōk-kāt'chō), Giovanni (1313-75), "father of Italian prose"; author of the 'Decameron', a storehouse of characters and plots used by Chaucer, Shakespeare, Keats, and many others: R-74, picture I-154
- Dante lectureship D-11
- scene of Decameron B-154
- Tuscan dialect I-153
- Boccherini (bōk-kā-rē'nē), Luigi (1743-1805), Italian composer and violoncello virtuoso; court musician at Madrid ('Minuet').
- Bocconia. *See in Index* Plume poppy
- Boche (bōsh), French slang word meaning murderous revolutionist; term applied to Germans, and particularly to German soldiers, during first World War.
- Bochum (bōk'gm), Germany, industrial city in Westphalia, 8 mi. e. of Essen; pop. 315,000; coal mines, iron and steel works.
- Bock, Fedor von (born 1880), German general; major in 1st World War; made commander of 3d Army Group 1920, of 1st Army Group 1938; led 1941 and 1942 offensives against Russia.
- Böcklin (bōk-lēn'), Arnold (1827-1901), Swiss painter, born Basel, Switzerland; his fantastic and weird paintings, marked by poetic perception, are rich in color and original in composition ('Sea Idyl'; 'Venus Reposing'; 'Isle of Death').
- Bodanzky (bō-dān'ski), Artur (1877-1939), American musical conductor, born Vienna; from 1915 principal conductor of German opera for Metropolitan Opera Company, New York City.
- Bode (bō'dū), Johann Elert (1747-1826), German astronomer, director of Berlin Observatory; Bode's law named for him: A-339
- Bo'den, Sweden, town in n. on Lule River near Lulea S-338
- Bode's Law, a system of figures for establishing the relative distances of the planets from the sun, propagated by Johann Elert Bode in 1795, but discovered about 1772 by Johann Daniel Titius of Wittenberg: A-339
- Bo'dhi Tree, or Bo Tree, the sacred fig (*Ficus religiosa*) under which the Buddha is supposed to have received the inspirations on which the

ü=French u, German ü; ġem, ġo; thin, then; ñ=French nasal (Jean); zh=French j (z in azure); k=German guttural ch

Buddhist religion is founded. The pipal tree outside the temple at Bodh Gaya, India, and the one in Anuradhapura, Ceylon, are revered as descendants of original: C-137
Bodleian (*bōd-lē'an*) Library, Oxford, England; public library of the university named for Sir Thomas Bodley who restored and reopened it 1602: L-105, *pictures* O-259, 260

Bodley, Sir Thomas (1545-1612), English scholar and diplomatist; sent by Queen Elizabeth on diplomatic missions to Denmark, France, and Holland; later gave bulk of his fortune and time to collecting and restoring Bodleian Library, Oxford: L-105

Bodmer (*bōd-mēr*), Carl (1809-1893), Swiss artist; in 1832-34 made a trip through the United States making copper plates for Prince Maximilian's 'Travels in the Interior of North America'; later gained recognition as a painter.

Bodoni (*bō-dō'nē*), Giambattista (1740-1813), Italian printer; superintendent of Duke of Parma's private presses; printed beautiful editions of the classics: T-174
 style of type, example B-177

Body, human. *See in Index* Anatomy; Physiology

Body louse P-67-8, *picture* P-69

Body of Civil Law (*Corpus Juris civilis*), compiled by Justinian J-231

Body pigments, in paints P-32

Body regulators, in diet F-146

Boehmeria (*bō-mē'ri-ā*), a genus of plants, shrubs, and trees of the nettle family, including the China grass or ramie. *See* China grass

Boeing, William E. (born 1881), airplane manufacturer, born Detroit; instructed in flying by Glen L. Martin; founded Boeing Aircraft Company, 1916; Daniel Guggenheim medal (1934) for "successful pioneering and achievement."

Boeing Aircraft Company, in Seattle, Wash. S-71b

Boeotia (*bō-ō'shi-ā*), district of ancient Greece n.w. of Attica; Thebes chief city: T-77, *map* G-154
 early alphabet A-135

Boerhaave (*bō'r'hā-vē*), Hermann (1668-1738), Dutch physician; professor at University of Leyden; used scientific methods in classifying and treating disease: N-72

Boerroe. *See in Index* Buru

Boers (*bōrz*), Dutch farmers of South Africa. *See also in Index* Boer War
 British, early relations with S-200-2
 Transvaal settled T-126
 World War rising (1914) S-166

Boer War (1899-1902) B-166-7
 events leading to S-200-2
 leaders: Botha B-207; Kitchener K-26; Rhodes R-99; Roberts R-117; Smuts S-166
 Lloyd George opposes L-173

Boethius (*bō-ē'thi-ūs*) (about 480-524), Roman statesman and philosopher ('Consolations of Philosophy', translated by King Alfred and by Chaucer).

Boettger (*būt'gēr*), Johann Friedrich (1681?-1719), German alchemist, maker of first European porcelain: P-332

Bofors cannon, *picture* M-9

Bog, spongy, wet ground usually composed of decaying vegetable matter and covered with coarse grass. *See also in Index* Swamp
 peat bogs P-98-9
 "quaking" M-272

Bogalu'sa, La., lumber manufacturing

town on Pearl River 60 mi. n. of New Orleans; pop. 14,604: L-207, *map* L-206

Bogardus, James (1800-74), American inventor, born Catskill, N. Y.; watch-maker by trade; invented gas meter, pyrometer, method for printing postage stamps (1839) adopted by British government; built (1847) first building using cast-iron beams: *picture* I-115

Bogaz Koi, also Boghaz Keui (*bō-gāz' kū'ē*), village in Turkey 85 mi. e. of Ankara; ancient ruins in vicinity

cuneiform tablets A-252, H-311-12

Boghaz Ichi. *See in Index* Bosphorus

Bog moss M-272

Bogotá (*bō-gō-tā'*), cap. of Colombia, near center; pop. 352,000: C-306, *map* C-305

'**Bohème**, La' (*lā bō-ēm'*), opera by Puccini, story O-229

Bohe'mia (German Böhmen), part of German protectorate of Bohemia and Moravia, annexed 1939; formerly a province of Austria-Hungary and later of Czechoslovakia: B-167, A-380, C-421, 422, *maps* C-422, G-66, E-326d
 commerce and manufactures P-342, B-288

emigration to U. S. I-23

folk-tales S-303d-e, m

glass-button industry B-288

history B-167; Huss and Hussite War H-363; Thirty Years' War T-80; first World War B-167; Germany acquires B-167, C-421-2

John Huss Day H-322

language H-363, C-422

national song N-26

Prague P-341-2

Bohemian Forest (German Böhmerwald), chain of mountains between Bohemia and Bavaria; highest peak Arber (4872 ft.): *map* G-66

Bohemian garnet G-28

Bohemians, a popular term for unconventional people B-167

Bohemians, or Czechs, a Slavic people B-167, C-421-2, S-162

language H-363, C-422

uprising in 1848, A-383, F-186

Bohemian waxwing, a small perching bird W-58

Bohemond (*bō-hē-mōnd'*) (1056?-1111), Norman crusader C-403

Böhlau (*bū'lau*), Helene (born 1859) German novelist and short story writer G-63

Böhme (*bū'mū*), or Böhmer (*bām*), Jakob (1575-1624), German theosophist and mystic; held nothing exists or is intelligible except through its opposite.

Böhmen (*bū'mēn*). *See in Index* Bohemia

Bohr (*bōr*), Niels H. (born 1885), Danish scientist, born Copenhagen; won Nobel prize in physics, 1922, for his theory of structure of the atom: *picture* P-188
 theory of atomic structure A-361, S-243-4, R-16, *diagram* A-360

Boileau (*bwā-lō'*), Nicolas (1636-1711), French poet, satirist, and critic, called "Lawgiver of Parnassus"; full name Boileau-Despreaux ('Epistles'; 'The Art of Poetry').

Boiler, of steam engine S-281, S-282

Boiling, cookery C-349

Boiling, distinguished from evaporation W-44

Boiling point W-44

lowering and raising W-44: vacuum lowers V-268

measured by thermometers T-78

mercury M-120
 water W-44

Bois de Boulogne (*bwā dū bō-lōn'yū*), park in Paris, 2100 acres, on north side of Seine River; famous for fashionable promenades; formerly site of many duels and highway robberies.

Boise (*bō'zē*), Idaho, largest city and cap. in s.w. on Boise River; pop. 26,130; center of fruit-growing, dairying, stock-raising, lumbering, farming, and mining district; hunting and fishing in vicinity: I-11, *map* I-8

hot springs I-7

irrigation project I-149
 state capitol, *picture* I-9

Bois-Guilbert (*bwā-gēl-bēr'*), Brian de, knight in Scott's 'Ivanhoe'.

Bois-le-Duc (*bwā lū dūk*), also s'Hertogenbosch, Netherlands, city 50 mi. s.e. of Amsterdam; pop. 42,000; noted cathedral; manufacturing, shipping.

Boito (*bō'ē-tō*), Arrigo (1842-1918), Italian composer and poet; best known for opera 'Mefistofele', based on Goethe's 'Faust'; also wrote libretti for operas by Verdi ('Otello' and 'Falstaff') and other composers.

Bojer (*bō'yēr*), Johan (born 1872), Norwegian novelist; an orphan, he was brought up by a laborer's family; spent many years abroad, particularly in France as newspaper correspondent; wrote realistic novels of Norwegian life with simple treatment, somber tone ('The Great Hunger'; 'The Power of a Lie'; 'The New Temple'; 'The Everlasting Struggle').

Bok, Edward William (1863-1930), American author, editor, and philanthropist, born in Holland; came to U. S. 1869; began work as office boy at 13; editor of *Ladies' Home Journal* 1889-1919; created \$100,000 American Peace Award 1923; erected bird sanctuary and Singing Tower in Florida ('Why I Believe in Poverty'; 'Americanization of Edward Bok'; 'A Man from Maine'; 'Perhaps I Am')
 Singing Tower F-115

Bokhara (*bō-kū'rā*), or Bukhara, former emirate and its capital in Asiatic Russia, n. of Afghanistan; following Russian Revolution Bokhara became a soviet republic; later divided between Turkmenistan and Uzbekistan; city of Bokhara (pop. 50,000) now included in Uzbekistan: T-158, *map* A-332b
 rugs R-173

Bo'la, missile used by gauchos A-279, S-206

Bolama (*bō-lū'mā*), cap. of Portuguese Guinea, w. Africa; pop. 4000; on island of same name; point of departure for transatlantic air route: *map* A-42a

Bolan (*bō-lān'*) Pass, picturesque defile 55 mi. long in n. Baluchistan, near Quetta; main highway from Kandahar to Indus valley.

Boldrewood, Rolf, pen name of Thomas A. Browne (1826-1915), Australian novelist; wrote many tales and novels of Australian adventure; work descriptive and full of local color; most popular works: 'Robbery under Arms', 'The Miner's Right', 'A Tale of the Golden West'.

Bolero (*bō-lā'rō*), a Spanish dance of sharp rhythm, generally accompanied with castanets; also the music for the dance, particularly compositions by Ravel and Mosz-

- kowski; in costume, a short jacket, with or without sleeves, resembling coat worn by Spanish peasants.
- Boleslav I** (*ból'sláv*), or Boleslav (called "Chrobry," the Great or Mighty), king of Poland 992-1025; raised Poland from poor, struggling principality to great power of Europe, extending from Bug to Elbe rivers and from Baltic Sea to the Danube.
- Boleyn** (*ból'ín*), Anne (1507-36), 2d queen of Henry VIII of England B-167, H-278
- Bolingbroke** (*ból'ing-brúk*), Henry St. John, Viscount (1678-1751), English statesman and writer; negotiated treaty of Utrecht (1713); intriguer for Stuart restoration; talented, but unscrupulous.
- Bolívar** (*ból'ê-vár*, Spanish *bó-lê-vár*), Simón (1783-1830), "the Liberator," South American general and statesman B-167-8, L-67h, picture L-67i
flag F-100, color plate F-90
Panama Congress called by L-67o
statue, picture V-276
- Bolívar**, a gold or silver coin, the monetary unit of Venezuela, worth about 20 cents; name applied also to 10-boliviano gold coin of Bolivia worth about \$3.65.
- Bolivia**, inland country of South America; cap. La Paz; area, about 420,000 sq. mi.; pop. 3,000,000; B-168-70, maps B-226, S-208b-c, d, Outline S-211
Andes Mountains A-194, 195
climate B-169
flag F-94, color plate F-88
history B-170: war with Chile C-208, B-168; boundary dispute with Paraguay P-67
Incas I-27
Independence Day H-323
Indians B-170, E-346, S-206c
literature L-67u
mines B-170: tin, picture L-67n
products B-169-70: alpaca wool A-134; bismuth B-148
transportation B-170
- Bolivia** cloth, a class of woolen or worsted pile fabrics used for coats, sold under different trade names.
- Boliviano** (*ból'ê-vê-â'nô*), the monetary unit of Bolivia, nominally worth 36½ cents in U. S. money.
- Boll** (*ból*), seed-capsule of cotton C-375-6
- Bolling Field**, at Anacostia, D.C., military air base and landing field 4 mi. s. of Washington; 340 acres purchased by government in 1918, 490 additional acres in 1929.
- Boll-weevil** W-65, C-380, picture C-378
damage to cotton I-89, C-382
how to combat W-65, I-90
monument to A-96
- Bollworm**, pink, a moth (*Pectinophora obsoleta*) injurious to cotton I-89
- Bologna** (*bó-lôn'yá*), Giovanni da, also Giambologna (1524-1608), Italianized name of the French-born Jean Boulogne, one of greatest sculptors of Renaissance: S-58
- Bologna**, railroad center of n. Italy; pop. 270,000: B-170, map I-156
- Bologna**, University of, Bologna, Italy, one of oldest European universities; famous for law and medical courses; early admitted women as students and teachers: B-170, E-171
first stationers B-179
law school U-260
- Bolom'eter**, an instrument for measuring radiation by the change in electrical resistance of a blackened conductor, in which the radiation produces a rise of temperature; invented by Prof. S. P. Langley.
- Bol'shevism**, doctrines of the radical wing of the Russian Social Democratic party B-170-1, R-189-94
counter-revolutions of the "Whites" W-174-5
Gompers' attitude G-119
land redistribution R-182
Lenin L-94
Marxism basis of doctrine M-73
religious policy R-182
royal family killed N-142
Trotzky T-144
- Bolting**, in flour milling F-119, picture F-118
- Bolton**, Herbert E. (born 1870), American historian, born Wilton, Wis.; professor of history at University of California; director of Bancroft library; authority on Spanish-American history ('Texas in the Middle 18th Century'; 'Anza's California Expeditions'; 'Spanish Borderlands'; 'Outpost of Empire').
- Bol'ton**, also Bolton-le-Moors, England, cotton-manufacturing borough in Lancashire 11 mi. n.w. of Manchester; pop. 178,000; home of Samuel Crompton and Richard Arkwright: map E-270a
- Boltonia**, a perennial bushy-branched plant of genus *Boltonia* of the composite family; has aster-like flowers with white, pink, or purple rays and yellow disks; also called false chamomile.
- Bolzano** (*bólt-sá'nô*) (German Bozen), province in Italian Tyrol, formerly belonging to Austria-Hungary; picturesque mountainous country; rich fruit-growing region: T-176
- Bolzano**, or Bozen, Italy, town in province of same name near the confluence of the rivers Talavera, Isarco, and Adige; winter resort of Gries on opposite bank of Talavera; fine 14th-century Gothic cathedral; pop. 40,000: map E-326d
Castle Runkelstein, picture A-380
- Boma**, properly Mboma, chief port and former cap. of Congo State; 60 mi. inland on n. bank of Congo River; white pop. 400, native 2500: map A-42a
- Bomb**, aerial A-307, picture A-74c
- Bomb**, depth, for fighting submarines S-314
- Bombard**, cannon of early type A-322
- Bombardier** (*bóm-bär-dēr'*) beetle B-82, picture B-84
- Bombay** (*bóm-bā'*), a presidency or province of India on w. coast; pop. 17,995,000; 77,221 sq. mi.: I-32, map I-31
- Bombay**, 2d city of India, on w. coast; pop. 1,160,000: B-171, map I-30
- Bombay hemp**. See in Index Sunn
- Bombazine**, a twilled cloth of silk and worsted.
- Bom'bidæ**, bumblebee family B-78
- Bombing** plane A-70, 74b, A-306-7, N-56a, pictures A-67, 74a, c, d, W-178n
balloon barrage against B-31
- Bombycidae** (*bóm-bis'ê-dê*), family of moths; includes the silkworm moth.
- Bombycillidae** (*bóm-bê-sil'ê-dê*), waxwing family of birds W-58
- Bon** (*bôn*), Cape, in Africa, on n. e. coast of Tunisia T-151, map A-42a
- Bona**, Algeria. See in Index Bone
- Bonaire**, island in colony of Curaçao. See in Index Curaçao
- Bonaparte** (*bô'nâ-pärt*), famous Corsican family B-171-2
- Bonaparte**, Caroline (died 1839), sister of Napoleon I; married Murat: B-172
- Bonaparte**, Charles Joseph (1851-1921), American statesman, born Baltimore B-172
- Bonaparte**, Elisa (1777-1820), sister of Napoleon I B-172
- Bonaparte**, Jerome (1784-1860), youngest brother of Napoleon I; king of Westphalia: B-172
- Bonaparte**, Joseph (1768-1844), eldest brother of Napoleon I; king of Naples, later of Spain: B-171
General Hugo adviser to H-352
in New Jersey N-93
- Bonaparte**, Louis (1778-1846), king of Holland, brother of Napoleon I, B-171-2
- Bonaparte**, Lucien (1775-1840), Prince of Canino, brother of Napoleon I B-171
- Bonaparte**, Maria Letizia (1750-1836), called "Madame Mère" (*mêr*), mother of Napoleon I B-171
- Bonaparte**, Napoleon N-5-10. See also in Index Napoleon I
- Bonaparte**, Pauline (1780-1825), sister of Napoleon I B-172
- Bonaventura** (*bô-nâ-vên-tû'râ*), Saint (1221-74), Italian theologian; general of Franciscan order and cardinal; real name Giovanni Fidanza; revered as a theologian and for his spotless character; 'Biblia Pauperum' ('Poor Man's Bible') attributed to him; feast day July 14.
- Bonaventure Island**, Quebec, 2½ mi. long, ¾ mi. wide, in Gulf of St. Lawrence: G-5
- Bonavista** (*bôn-â-vis'tâ*), name of bay, cape, district, and fishing town on e. coast of Newfoundland; pop. of town, 4000: map C-50c
- Bonci** (*bôn'chê*), Alessandro (1870-1940), Italian tenor; sang with Manhattan and Metropolitan Opera companies, New York; after 1910 appeared principally in concert.
- Bond**, Carrie Jacobs (born 1862), American song writer, born Janesville, Wis.; composer of 'A Perfect Day' and other songs of simple style and appealing sentiment which have won great popularity.
- Bond**, Sir Robert (1857-1927), Newfoundland statesman; premier 1900-09; leader of Liberal Opposition; retired from public life 1914; opposed union with Canada.
- Bonded warehouse**, one in which goods subject to excise or import duty may be stored until ready for shipment or sold; warehouse owners put up surety bond to guarantee collection of tax before goods are released.
- Bondfield**, Margaret (born 1873), English labor leader, first woman cabinet member; born Somerset; daughter of a lace maker of Norman ancestry; began to work in her teens; fought for suffrage and organization of women workers; in House of Commons 1923-24, 1926-31; secretary to Ministry of Labor, 1924; minister of labor, 1929-31.
- Bonding**, in masonry B-238
- Bonds**, interest-bearing securities issued by a government or a corporation S-291-2, B-172
credit instrument C-394
financing business E-150
gold S-291
government S-291, W-170
how to figure return on P-121
insurance companies' holdings I-96

û=French u, German ü; gem, gô; thin, then; ù=French nasal (Jean); zh=French j (z in azure); k=German guttural oh

- investment trusts T-147
mortgage, as security S-291
open market operations, Federal Reserve Bank F-22
registered S-291
war savings N-12g
- Bone, David William** (born 1874), British novelist and mariner, born Glasgow, brother of Sir Muirhead Bone; entered merchant service 1890; associated with Anchor Line after 1899, becoming a captain in 1915; wrote about life at sea ('The Brassboulder'; 'Broken Stowage').
- Bone, Sir Muirhead** (born 1876), British etcher and painter, born Glasgow, Scotland; master in use of dry point; notable portraits and architectural etchings; official artist on western front and with British fleet, 1916-18.
- Bône** (*bôn*), also *Bonna*, Algeria, fortified seaport and manufacturing city about 80 mi. n.e. of Constantine; pop. 86,000; just south of Bone lie the ruins of Hippo, see of St. Augustine: map A-42a
- Bone B-172-3.** See also in *Index*
Skeleton; Spine
broken, setting F-65; right and wrong way, picture B-172
cell formation C-122
chemical composition B-172
diseases: rickets V-311a, 312
growth B-172; children C-198; parathyroid affects G-100; minerals necessary M-185, F-145
hardness, cause of B-172
hollow in birds B-120
marrow produces blood corpuscles B-157a
products B-172-3
bone-black C-144, B-172-3
bone-tar T-12
buttons B-288
gelatin G-25
glue G-107
phosphorus P-177
Bone-black C-144, B-172-3
Bone porcelain P-330, 332
- Boneset**, or thoroughwort, a perennial herb (*Eupatorium perfoliatum*) of the composite family with stout hairy stem; leaves, opposite, lance-shaped, and united at base; small white flower heads in large clusters; bitter tea made from dried plant formerly a household remedy for colds and fevers.
- Bone turquoise.** See in *Index* Odontolite
- Bongo** (*bông'gô*), or Obong, a reddish-brown people of e. Sudan, of medium height and good muscular development; the women wear a metal ornament in the upper lip and extend the lower lip by means of a wooden plug.
- Bonheur** (*bôn-ür'*), Marie Rosalie (Rosa) (1822-99), French artist B-173-4, P-22
- Bonhomme Noël** (*bôn-ôm' nô-êl'*) C-229b
- 'Bonhomme Richard'** (*bôn-ôm' rê-shâr'*), ship of John Paul Jones J-226, picture R-90
- Boniface, Saint** (680-754), English missionary to Germany; festival June 5: B-174
Christmas tree legend C-227
- Boniface**, name borne by nine popes B-174. For complete list see in *Index* Pope, table
- Boniface VIII** (1235?-1303), pope B-174
struggle with Philip IV P-162-3
- Boniface IX** (died 1404), pope B-174
- Bonifacio** (*bô-nê-fü'chô*), Strait of, between Sardinia and Corsica, map I-156
- Bonin** (*bô'nên*) Islands. See in *Index* Ogasawara Jima
- Bonito** (*bô-nê'tô*), a fish related to the tunny T-155
- Bonn** (*bôn*), Germany, city in w. Germany; pop. 100,000: B-174, map G-66
- Bonn, University of**, at Bonn, Germany, founded in 1818 by Frederick William III of Prussia; faculties of law, medicine, philosophy, Roman Catholic theology, Protestant theology; generally ranked 2d among leading German universities.
- Bonnaffé** (*bô-nâ-fâ'*), Edmond (1825-1903), French furniture collector and expert
quoted I-100
- Bonnard** (*bôn-nâr'*), Pierre (born 1867), French painter, born Paris; intimate interiors, figures, landscapes; forceful, sometimes daring, use of color; has been called a "divergent Impressionist."
- Bonnat** (*bô-nâ'*), Léon (1833-1922), French painter, first known for genre and religious paintings, but most famous for portraits distinguished by realism, power, and warmth of color.
- Bonnet** (*bô-nê'*), Charles (1720-93), Swiss naturalist, philosopher, and psychologist; studied behavior of ants; gave physiological explanation of mental life.
- Bon'net**, Stede (died 1718), American pirate, former English Army officer and respected plantation owner in Barbados; bought sloop *Revenge* and turned to piracy for reasons unknown; hunted for prizes for a time in company with the notorious Captain Edward Teach. Pardoned once by governor of North Carolina; sailed again, in *Royal James*, captured 1718, and hanged in Charleston, S. C.: C-155
- Bonnet monkey**, or macaque M-230, picture M-229
hand, picture A-225
- Bonnet rouge** (*bô-nê' rûzh*). See in *Index* Liberty cap
- Bonneville** (*bôn-vîl'*), Benjamin L. E. (1795?-1878), American soldier and explorer, born France; served in Mexican, Seminole, and Civil wars; explored in Rocky Mts. and California 1831-36; Lake Bonneville named for him: I-10
- Bonneville, Lake**, extinct glacial lake in Utah G-150a
- Bonneville Dam**, on Columbia River D-6b, C-315, O-244, picture D-8
- Bonney, William H.** See in *Index* "Billy the Kid"
- Bonnie Prince Charlie**, popular name for Charles Edward Stuart, grandson of James II of England; also called the Young Pretender: P-344-5
- 'Bonny Barbara Allan'**, a ballad, quotation from F-136
- Bon'sels, Waldemar** (born 1881), German author of short stories and books of travel ('Maya the Bee'; 'Mario and Gisela').
- Bontemps, Arna** (born 1902), Negro poet and novelist, born Alexandria, La.; for adults: 'Drums at Dusk', 'Black Thunder'; for children: 'Popo and Fifina', 'You Can't Pet a Possum', 'Sad-Faced Boy'.
- Bonus**, something given in addition to what is strictly due
labor L-43
soldiers' P-118; veto of Calvin Coolidge overridden C-353, of Herbert Hoover H-337, of F. D. Roosevelt R-146j
- Booby**, a large sea bird closely related to the gannet, so called because of its apparent stupidity and tameness when nesting G-5
- Boogie-woogie**, a form of jazz music devised by the American Negro; essentially for the piano; improvised melody, in $\frac{6}{8}$ or $\frac{4}{4}$ time, with simple bass chords played in unusual order.
- Bookbinding** B-182-3
case binding B-187
commercial, beginnings B-182-3
decorating and lettering cover B-182, 183, picture B-187
end-papers B-187
famous binders and their work B-183, picture B-182
medieval book covers B-178, 182
signatures B-184, picture B-186
- Book collecting** B-188-9
- Book credit** C-393
- Bookkeeping** A-5-7
calculating machines C-20
- Book lice**, minute insects, generally wingless, of order *Corrodentia*: found in old books and papers, furniture, bedding; they feed on microscopic molds; they do not injure books or anything else.
- Bookmobile**, or book bus L-106d, pictures L-106c, e
- Book of Common Prayer.** See in *Index* Prayer, Book of Common
- Book of Kells** B-178
- 'Book of Mormon'** M-258
- 'Book of the Dead'** E-204
- Book plates** B-189
- Books and bookmaking** B-175-91. See also in *Index* Bibliography; Book-binding; Bookselling; Engraving and etching; Illustration of books; Libraries; Literature for children; Manuscripts; Paper; Printing; Publishing; Reading; Story-telling; Type; Typography
ancient and prehistoric: Babylonia B-175; China C-209, P-346; Egypt B-175, E-204, 206, 210, C-347a; Greece B-175, 189; Hittites H-311-12; Rome B-175
bibliographical description B-106, B-181
binding B-182-3, 186-7
blind, books for B-156-7
block books B-180
censorship P-348
chained, picture L-104
children's L-157-64
child's own library, graded list L-110-21
first publisher of L-187
story-telling S-300-303p
China C-221f-g
clay tablets, ancient books B-8, B-178, N-146, H-311-12, E-210, pictures L-103, W-184
codex B-175, 177: survivals B-178
collecting B-188-9
colophon B-181
copyrights C-362
early printed (incunabula) P-346-7, T-173-4
first editions B-188
horn book, pictures E-176, E-165
illumination B-178, 180, pictures B-178, 179, color plates B-176a-b, 178a-b
illustration E-293-8
medieval manuscripts B-176-80
oldest book in the world C-347a
pages, how laid out for printing B-184-5
paper P-56-61
papyrus B-175, 178, E-206
parchment and vellum B-176, 178
printing P-346-8, B-180-1
reading R-56-8
scrolls B-175-6, pictures B-175, 176, J-215

Key—cápe, át, fâr, fâst, whát, fâll; mē, yēt, fērn, thêre; ūe, bīt, rōw, wón, fôr, nôt, dq; cūre, bútt, rŷde, fŷll, búrn;

- selling and publishing B-189-91
 sizes of books B-181
 title page introduced B-181
 typography T-172-4
 universities, medieval B-179-80
- Bookselling** B-189-91
 ancient Rome and Greece B-189
 consignment B-190
 early printers as booksellers B-190
 France B-180, 190
 Germany B-190, L-93
 medieval manuscripts B-179-80
 prices and discounts B-190-1
 subscription B-190
- Book Week**, a week in November designated annually for promotion of the reading and sale of children's books; originally proposed in 1919 by Franklin K. Mathews, librarian, Boy Scouts of America; first sponsored by the American Booksellers' Association with endorsement of the American Library Association; now backed by these and many other national and local organizations. Headquarters, *Publishers' Weekly*, New York City.
- Bookworm**, a beetle B-84
- Boom**, of a sailboat B-164
- Boomer**, or old man, name for a species of kangaroos K-1
- Boom'erang** B-192, *picture* B-193
- Boomer State**, one of the popular names for Oklahoma, referring to its oil booms.
- Boondoggling**, wasteful activity on Federal relief projects; word came into use in 1935 and 1936 during investigations of federal expenditures. Its origin uncertain; the noun, boon-doggie, is popularly believed to mean a gadget.
- Boone**, Daniel (1734-1820), pioneer B-192, K-13, U-238, *picture* F-15
 Cumberland Gap Historical Park N-21
 Pioneer National Monument N-22c
- Boone**, Iowa, clay-manufacturing and coal-mining center 35 mi. n.w. of Des Moines; extensive agricultural trade; pop. 12,373; *map* I-120
- Boonesborough**, Ky., village on Kentucky River 18 mi. s.e. of Lexington
- Boone** founds B-192
- Boone's Creek** B-192
- Boone's Trace**, later called Wilderness Road R-116
- Boötes** (bō-ō'tēz), northern constellation containing the bright star Arcturus; near the Great Bear; name means "the herdsman"; *charts* S-275c, d, g
- Booth**, Ballington (1859-1940), English-American religious leader, son of Gen. William Booth S-19-20
 founds Volunteers of America S-20
- Booth**, Edwin (1833-93), American actor, born Belair, Md.; foremost American tragedian of his day, perhaps not equaled by any successor; won great fame also in England; played Shakespeare, notably Hamlet, King Lear, Othello, Richard III, Shylock, and Macbeth.
- Booth**, Evangeline Cory (born 1865), English-American religious leader, born London, England; daughter of Gen. William Booth, founder of Salvation Army; commander in chief of Salvation Army in U. S. 1904-34; general of international Salvation Army forces 1934-39.
- Booth**, John Wilkes (1839-65), American actor, born Hartford County, Md.; brother of Edwin
 assassinates Lincoln L-145
- Booth**, Maude Ballington (born 1865), wife of Ballington Booth S-20
- Booth**, William (1829-1912), founder of Salvation Army; English minister, author ('In Darkest England and the Way Out', a work offering remedies for pauperism): S-19
- Booth**, William Bramwell (1856-1929), Salvation Army leader, born Halifax, England; succeeded father, William, as commander in chief of Salvation Army, 1912.
- Boothe**, Clare (Mrs. H. R. Luce) (born 1903), writer, born New York City; edited *Vogue* 1930, *Vanity Fair* 1931-34, then turned to writing plays ('The Women'; 'Kiss the Boys Goodbye'); later became a war correspondent ('Europe in the Spring'); elected member U. S. Congress November 1942.
- Boothia**, Gulf of, inlet of Arctic Ocean in northern Canada, *map* C-50b-c
- Boothia** (bō'thi-ā) Peninsula, northernmost peninsula of American mainland, *map* C-50b-c
 north magnetic pole P-280
- Booth-Tucker**, Frederick St. George de L. (1853-1929), commander of Salvation Army in U. S. (1896-1904), son-in-law of William Booth.
- Bootle**, England, at the mouth of the Mersey; great docks are part of dock system of Liverpool, of which Bootle is suburb; pop. 77,000.
- Boots and shoes** S-130-3. *See also in Index* Shoes
- Bopp** (bōp), Franz (1791-1867), German philologist, one of the founders of the scientific study of languages ('Comparative Grammar of the Indo-European Languages').
- Bora** (bō'rā), Katharine (1499-1552), wife of Luther L-221
- Bora Bora**, one of Society Islands native, *picture* P-9
- Boric acid**. *See in Index* Boric acid
- Boraginaceae** (bō-rāg-i-nā'sē-ē), the borage family, a large plant group consisting mainly of rough-haired annual or perennial herbs distributed over temperate and tropical regions of the world; includes forget-me-not, viper's bugloss, Virginia cowslip, and heliotrope.
- Borah** (bō'rā), William Edgar (1865-1940), American politician, born Fairfield, Ill.; U. S. senator from Idaho after 1907; a Republican of independent views; brilliant debater; foe of monopoly; partly responsible for creation of Department of Labor; opposed League of Nations, World Court, Versailles Treaty; defended prohibition; as Chairman Senate Foreign Relations Committee championed Conference for Limitation of Armaments.
- Borah Peak**, highest point in Idaho, 12,655 ft.; in the Pahsimeroi range in Lemhi National Forest, e. cent. Idaho; named after William E. Borah, senator from Idaho.
- Borate**, a salt of boric acid.
- Borax**, a salt (sodium borate, Na₂B₄O₇) of boric acid and sodium B-192, 194
 bead test for metals B-194
 glass toughened by G-104
 sources B-192, 194, M-183, C-207a
- Borchgrevink** (bōrk'krē-vēnk), Carsten E. (born 1864), Norwegian scientist and explorer, born Oslo; surveyed in Australia; made scientific observations in South Seas; commanded *Southern Cross* expedition to South Pole 1898-99 ('First on the Antarctic Continent') in Antarctic A-217
- Bordeaux** (bōr-dō'), France, port on w. coast; pop. 260,000: B-194, *map* F-179
- Bordeaux**, University of, established at Bordeaux, France, in 1441; self-governing until reign of Francis I, thereafter under state control; faculties of science, letters, law, medicine, and pharmacy.
- Bordeaux mixture**, poisonous spray S-263
- Borden**, Sir Frederick William (1847-1917), Canadian statesman, born Cornwallis, Nova Scotia, practised medicine; entered Parliament 1874; minister of militia and defense 1896-1911.
- Borden**, Sir Robert Laird (1854-1937), prime minister of Canada B-194-5
- Border Patrol**, of U.S. Immigration Service U-223
- Borders**, The, territory on both sides of boundary between England and Scotland.
- Border terrier** D-82
- Boré** (bō-rā'), Étienne de (1741-1820), Franco-American sugar planter L-204
- Bore**, of firearms C-75
 artillery A-321, 322
 choke-bore F-53
 rifle F-50; gyroscope principle G-191
 smooth F-50, 52
- Bore**, a tidal wave T-91
 Bay of Fundy T-91, *picture* T-92
 Hangchow, China H-210
- Boreas** (bō-rē-ās), in Greek mythology, god of the north wind A-27
- Borecole** (bōr'kōl), collards, or kale, common names generally applied to *Brassica oleracea* variety *acephala*, a member of the mustard family. Thick curly leaves widely used as vegetable greens: C-1-3
- Borer**. *See in Index* Boring animals
- Borer**, or hagfish, an eel-like parasitic fish P-70
- Borger**, Tex., city 47 mi. n. of Amarillo; pop. 10,108; petroleum products.
- Borghese** (bōr-gā'zā), distinguished Italian family, originally from Siena, later residing in Rome. Camillo (1550-1621) became Pope Paul V in 1605 and assisted family to great power. Camillo Filippo Ludovico, Prince Borghese (1775-1832) was second husband of Pauline Bonaparte, Napoleon's sister.
- Borghese Palace**, museum in Rome, *table* M-392
- Borghese vase**, *picture* E-333
- Borghese Villa**, formerly suburban estate of Borghese family just outside Porta del Popolo in Rome; now property of state and officially called Villa Umberto I; art gallery contains works by Raphael, Bernini, Titian, and others, some of which were brought from Borghese Palace, winter home of family in Rome; many of the Borghese treasures are now in Paris.
- Borgia** (bōr'gā), the name of a powerful family of Renaissance Italy B-195
- Borgia**, Caesar (1476-1527) B-195
 Leonardo da Vinci and V-300
- Borgia**, Francis (1510-72), of the Spanish Borgia family, head of Jesuit order: B-195
- Borgia**, Lucretia (1480-1519), Duchess of Ferrara B-195
- Borglum**, Gutzon (1871-1941), American sculptor B-195, S-64
 Mt. Rushmore memorial S-217, *picture* S-220
 statues N-80, S-115, *picture* S-63
- Borglum**, Solon Hannibal (1868-1922), American sculptor, brother of Gutzon, born Ogden, Utah S-64

ü=French u, German ü; gem, go; thin, then; ñ=French nasal (Jean); zh=French j (z in azure); k=German guttural ch

- Bori, Lucrezia** (*bō'rē*) (born 1888), Spanish lyric soprano, born Valencia, of Italian descent; made debut in Rome in 'Carmen'; sang with Metropolitan and Ravinia Opera companies; retired 1936.
- Boric acid**, or *boracic acid*, a mild antiseptic (H_2BO_3) containing boron, found in nature and also prepared, in crystalline form B-192, 194
glass toughened by G-104
pottery glaze uses P-328
- Boring animals**
hagfish, or borer P-70
insects I-89, 90: carpenter bee B-77-8; carpenter wasps W-34; corn borer I-89, 90, *pictures* I-93; "death-watch" beetle B-84; termite T-52a
oyster drill S-168, O-264
piddock, *picture* S-108
sponge S-260
teredo, or shipworm C-4
- Boring machines** T-111, 112, *pictograph* T-110a
- Boris** (*bō'ris*) III (1894-1943), king of Bulgaria B-271
- Boris Gudenof** (*gō'dā-nōf*) (1551?-1605), Russian czar; gained throne 1598; while regent, bound peasants as serfs to the soil (1557); died amid uprisings in favor of the first False Demetrius; subject of play by Pushkin, opera by Moussorgsky.
- Bormann, Martin** (born 1900), German Nazi leader, born Halberstadt, cent. Germany; appointed Hitler's successor after Goering Feb. 1942.
- Borneo** (*bō'r-nē-ō*), island in Malay Archipelago; over 290,000 sq. mi.; pop. 3,000,000: B-196-8, *maps* E-142, A-332c, P-10b
animals B-197: orang-utan O-240; proboscis monkey M-230, *picture* M-229
people B-196
political divisions B-197
superstitions B-196
- Borneo camphor**, or *borneol* C-41
- Bornholm** (*bōrm'hōlm*), island of Denmark; 227 sq. mi.; pop. 46,000: D-52, *map* D-53
- Bornite** (*bōrn'it*), also *erubescite*, a copper-iron sulphide, mined in British Isles and United States; iridescent color; chemical formula Cu_3FeS_4 : M-182
- Boro Budor** (*bō'rō bō'dōr*), temple in Java J-205, *picture* J-204
- Borodin** (*bō-rō-dēn'*), Alexander (1834-87), Russian composer ('In Central Asia', for orchestra; 'Prince Igor', opera; symphonies, string quartets, and songs); a chemist by profession, took up musical composition as recreation.
- Borodino** (*bō-rō-dēn-ō'*), Russia, village 80 mi. w. of Moscow; scene of bloody but indecisive battle (1812) between Napoleon and Russians.
- Bor'on**, a chemical element C-175, *table* C-168. See also in *Index* Boric acid atomic structure, *diagram* A-361
- Borosilicate** G-104
- Borough** (*bōr-ō*), a municipal corporation forming a separate village or town or a part of a large city
London L-190
New York City N-134
- Borowski** (*bōr-ōf'skē*), Félix (born 1872), American composer, born in England of Slavonic parentage; president, Chicago Musical College 1916-25; professor of musicology, Northwestern University; music for orchestra, organ, piano.
- Borromean Islands**, in Lake Maggiore, Italy, *picture* E-321
- Borromeo** (*bōr-rō-mā'ō*), Saint Carlo (1538-84), cardinal and archbishop of Milan; transformed his diocese from one of license and disorder to model city; one of chief factors in Counter-Reformation in Catholic church; feast day November 4: I-166
- Borrow, George** (1803-81), English traveler, friend of gypsies, author ('Lavengro'; 'The Romany Rye').
- Bors**, Sir, one of knights of Round Table R-160
quest for Grail G-1
- Borsch**, Russian soup colored with beet juice.
- Borts**, or *bortz*, small and inferior diamonds D-60
used for wire dies W-121
- Bor'zoi**, or Russian wolfhound D-79, 83, *picture* D-81
- Bosanquet, Bernard** (1848-1923), English philosopher; lecturer at University College, Oxford; professor moral philosophy, St. Andrews University; he said, "Logic is the clue to reality, value and freedom" ('Psychology of Moral Self'; 'History of Aesthetic').
- Bosch, Hieronymus** (1460?-1516), Flemish painter, famous as illustrator; portrayed scenes of everyday life in caricature; painted religious pictures; important colorist.
- Bosch, Karl** (1874-1940), German chemist; developed process of large-scale production of ammonia for which he was awarded Nobel prize in chemistry for 1931 jointly with Dr. Friedrich Bergius: N-148
- Bosco** (*bōs'kō*), Giovanni Melchior (John), Saint (1815-88), Italian founder of Salesian order, Catholic monastic society for training of street boys for useful lives; canonized 1934.
- Bose** (*bōs*), Sir Jagadis Chunder (1858-1937), Hindu physicist, botanist; at Presidency College, Calcutta, after 1885; founder Bose Research Institute, Calcutta; noted for theory that plants have nervous organizations ('Plant Response'; 'Motor Mechanism of Plants').
- Bosio** (*bōz-yō'*), Francois Joseph (1769-1845), French court sculptor of neo-classic school; typical of his style are bust of Josephine in Dijon and bronze equestrian statue of Louis XIV in Paris.
- Bosnia** (*bōz-nī-ā*) and Herzegovina (*hērt-sē-gō-vē'nā*), part of Yugoslavia; nearly 20,000 sq. mi.; pop. 1,900,000: B-198, Y-212-14, *map* B-18. See also in *Index* Yugoslavia people B-198, Y-212, S-162
scene in Sarajevo, *picture* B-19
World War outbreak (1914) W-149
- Bosniaks**, people of Bosnia B-198, S-162
- Bosporus** (*bōs'pō-rūs*), or *Boghaz Ichi*, strait 18 mi. long between Sea of Marmara and Black Sea B-198, *map* B-154, *picture* T-159
World War, 1st W-164
- Bos'si** (*bōs'sē*), Marco Enrico (1861-1925), Italian organist and composer ('Paradise Lost' and 'Song of Songs', cantatas; operas; organ and chamber music).
- Bossuet** (*bōs-wē'*), Jacques Bénigne (1627-1704), French preacher; bishop of Meaux and tutor to son of Louis XIV; considered one of world's greatest pulpit orators.
- Boston**, Mass., state cap.; pop. 770,816; B-199-203, *map* M-82
airplane view, *picture* M-85
Christian Science Mother Church, *picture* E-157
- Christmas celebration C-229d
colonial trading center A-165
early musical center M-316
education B-201, 202: first public high school E-179
Faneuil Hall B-202, A-271, *picture* B-201
Federal Reserve Bank (1st) and district, *map* F-22
government M-302
harbor, spring tide T-91
historic persons and places B-200-2
history B-202-3
Winthrop founds W-119
harbor in 1630, *picture* U-233
first newspapers N-106
Stamp Act, reading of, *picture* R-82
Boston Massacre R-86
Boston Tea Party R-83
Revere's ride R-80-1, B-202
Bunker Hill battle B-271-2: Monument B-202, *picture* B-201
fire, great B-203
juvenile court J-232
museum of fine arts, *table* M-392
naval base, *map* N-51
Old Ironsides N-56c
Old State House, *pictures* B-201, D-27
police strike and Coolidge C-352
Boston College, at Boston, Mass., men; Roman Catholic; chartered 1863; arts, science, law.
Boston Common, famous park B-200
Boston Ivy I-176
Boston Latin Grammar School E-175
Boston Massacre R-86
Adams, John A-12
Hancock, John H-206
Boston Mountains, a southern range of the Ozarks, in Arkansas O-266
Boston Museum of Fine Arts, *table* M-392
Boston Navy Yard, or Charlestown Navy Yard, at Boston, Mass.; established 1800; builds and repairs auxiliaries and destroyers, also repairs cruisers: B-202
Boston Port Bill, one of the Coercive Acts passed by British Parliament (1774) after "Boston Tea Party"; closed port, removed seat of government to Salem, and demanded reparation: R-83
Boston Post Road, early American highway between New York City and Boston R-116
Boston Public Library B-201, *picture* B-200
paintings: by Abbey, *pictures* A-315, 316; by Sargent S-29, *picture* P-353
Boston Tea Party R-83, *picture* R-83
Adams, Samuel, organizes A-16
Revere, Paul R-81
Boston terrier D-81, *picture* D-82
Boston University, at Boston, Mass.; nonsectarian, chartered 1869; liberal arts, business administration, practical arts and letters, music, theology, law, medicine, education, religious education and social service, graduate arts and science.
Bostwick, Arthur Elmore (1860-1942), librarian and writer, born Litchfield, Conn.; librarian, St. Louis Public Library 1909-38, later associate librarian; author of books and articles on library work, science, and literature.
Boswell (*bōz-wēl*), James (1740-95). Scottish author; friend and biographer of Dr. Johnson: J-225-6, *picture* C-347b
Bosworth Field, in Leicestershire, England, scene of final battle of Wars of Roses (1485), in which Richard III was killed R-105
Botanical gardens Z-226

Key—cāpe, āt, fār, fāst, whqt, fql; mē, yēt, fērn, thēre; īce, bīt; rōw, wōn, fōr, nōt, dō; cūre, būt, rŭde, fŭll, bārn;

- Botany**, the study of plant life B-203-5, *Outline* B-205-7. *See also in Index* Plants; and chief subjects listed below
- algae A-118-20; seaweed S-72-3 anatomy and morphology B-203, A-191, *Outline* B-206
- bacteria B-12-13
- bibliography B-207, H-313h
- bulbs, tubers, and rootstocks B-269
- cell as life unit C-121-2
- classification or taxonomy B-203, P-244, *Outline* B-205; Linné's work L-148-9; principles B-116
- ecology B-145a-46, *Outline* B-206
- economic, *Outline* B-206
- ferns F-24-6
- flowerless plants, or cryptogams S-75, list N-41, *Outline* B-205
- flowers F-120-7
- fruits F-214
- fungi F-218, M-306-7
- heredity, Mendel's laws H-284
- history B-203
- leaves L-88-90
- liverworts L-166
- mosses M-270-2
- physiology P-207, P-234-44, *Outline* B-206
- reproduction B-112, *pictures* B-113, H-285, *Outline* B-206
- roots R-153
- seeds and spores S-73-5, F-214
- trees T-130-7
- Botany Bay**, inlet on e. coast of Australia, near city of Sydney; so named by Captain Cook (1770), because of variety of flora.
- Bot fly**, fly whose larvae live under the skin of animals F-129
- Botha** (bō'tā), Louis (1862-1919). Boer leader, later prime minister of Union of South Africa B-207, S-166
- Bothnia**, Gulf of, arm of Baltic Sea. between Finland and Sweden. *map* N-173
- coasts F-44, S-335, 336
- Bothwell**, James Hepburn, Earl of (1536?-78), powerful Scottish noble; dissolute, picturesque ruffian; 3d husband of Mary Queen of Scots: M-74
- Bo tree**, species of wild fig sacred to Buddhists T-136
- Buddha's meditations under B-259
- Ceylon's ancient tree C-137
- Botsford**, Amos (1744-1812), Canadian statesman, born Newtown, Conn.; a Loyalist in the American Revolution; emigrated to New Brunswick; first speaker of New Brunswick's House of Assembly 1785-1812.
- Bottego River**, or Omo River, Ethiopia. flows into Lake Rudolf, *map* E-308
- Botticelli** (bōt-tē-chēllē), Sandro (1444-1510), Florentine painter, with poetic feeling and richly decorative style; pupil of Fra Filippo Lippi; 'Birth of Venus'; illustrations for Dante's 'Divina Commedia'; frescoes in Sistine Chapel: P-16
- 'Primavera', *picture* P-16
- Bottineau** (bōt'i-nō), N. D., town in n., 60 mi. n.e. of Minot; pop. 1739; state school of forestry.
- Bottlenecks**, in industry N-12d
- "Bottle" pins, in bowling B-207
- Bottles**, blown by machines G-104, *picture* G-105
- how corks are made C-366
- Bottle tree** (*Sterculia rupestris*), native to Australia, with trunk shaped like a bottle, branches appear to grow out of top; stems contain a quantity of water, which is utilized by travelers: *picture* A-375
- Bottling**, of beverages W-46
- milk D-5, *pictures* M-172b, D-3
- Bottom**, clownish rustic in 'Midsummer Night's Dream' M-162
- Botulism**, poisoning caused by food infected with the *Bacillus botulinus*; affects the central nervous system. *See also in Index* Ptomaine poisoning
- Bouchard** (bū-shār'), Henry (born 1875), French sculptor; especially noted for simple and vigorous portrayals of everyday life of workers.
- Bouchardon** (bū-shār-dōn'), Edmé (1698-1762), French sculptor S-60
- Boucher** (bū-shā'), François (1703-70), gay, brilliant French painter of Pompadour era, styled "Anacreon of painting."
- Boucher de Crèvecœur de Perthes** (bū-shā' dū krēv-kūr' dū pērt'), Jacques (1788-1868), French antiquarian
- discoveries of ancient man M-45
- Boucicault** (bū-sē-kō'), Dion (1822-90), Irish-American playwright and actor born Dublin; won success with 'London Assurance' before he was 20; acted first (1852) in 'The Vampire', his own melodrama ('The Octoroon'; 'The Colleen Bawn'; 'The Corsican Brothers').
- Boudicca**. *See in Index* Boadicea
- Boudinot** (bū'di-nōt'), Elias (1740-1821), American philanthropist and Revolutionary patriot, born Philadelphia; president of Continental Congress (1782); member House of Representatives 1789-1805; director of the mint 1805-21; aided education of Indians and deaf-mutes.
- Boudinot**, Elias (Indian name, Galagina, *kil-ke-nah*, meaning "The Buck") (1803?-39), Cherokee editor, born Georgia; took name of Elias Boudinot, the philanthropist; worked for education of Indians; removed to Indian Territory (1839) where he was murdered by some of his tribesmen for supporting the Indian policies of the U.S. government.
- Bougainville** (bū-gān-vēl'), Louis Antoine de (1729-1811), French navigator, served in French army and navy; sailed around world 1766-69; largest of Solomon Islands, a strait adjoining, and a strait in New Hebrides named for him
- explores Samoan islands S-20
- Bougainvillea** (bū-gān-vēl'-ā), a small tropical genus of climbing shrubs with long clusters of small flowers surrounded by large, brilliantly colored bracts; named for Louis de Bougainville; *Bougainvillea spectabilis*, with deep rose bracts, and *Bougainvillea glabra*, with rose-red bracts, are grown in greenhouses.
- Bougainville** (bū-gān-vēl') Island. *See in Index* Solomon Islands
- Boughton** (bū'tn), George H. (1834-1905), English-American painter, born Norwich, England
- paintings, *pictures* I-151, P-369
- Bouguereau** (bū-gū-rō'), Adolphe W. (1852-1905), French painter; classicist in line but influenced by realism ('The Birth of Venus').
- Bouillon** (bū-yōn'), ancient duchy in the Ardennes; possession of Godfrey de Bouillon, leader of First Crusade; now part of Belgium.
- Boulanger** (bū-lān-zhā'), Georges E. J. M. (1837-91), French general, anti-republican, Royalist; convicted of treason; committed suicide.
- Boulder**, Colo., city 25 mi. n. of Denver at mouth of Boulder Canyon; agricultural and mining interests; pop. 12,958; noted health and summer resort; state university.
- Boulder City**, Nev., unincorporated settlement at Boulder Dam; about 20 mi. s.e. of Las Vegas; built by U.S. government in 1931.
- Boulder clay**, or glacial till G-96, I-2a
- Boulder Dam**, in Black Canyon of the Colorado River D-6, 6b, 7, 8, C-315, *pictures* D-6, 6b
- Boulder Dam National Recreational Area** N-22e
- Boulders**, left by glaciers I-3
- Boulle** (bōl), André Charles (1642-1732), French cabinetmaker, famous for inlay work I-101-2, F-222
- Boulle**, a furniture decoration I-101-2
- Boulogne**, or Boulogne-sur-Mer (bō-lōn'yū sūr mēr), France, fortified seaport on English Channel; pop. 53,000; fishing and commercial center; taken by Germans 1940: *map* F-179
- Roman lighthouse L-132
- Boulogne-sur-Seine** (sūr-sēn'), suburb s.w. of Paris; pop. 97,000; gave its name to Bois de Boulogne.
- Boulton**, Matthew (1728-1809), English manufacturer and engineer, partner of Watts W-57
- Bouncing Bet**, a perennial plant (*Saponaria officinalis*) of the pink family having clusters of delicately fragrant white or pink flowers; also called soapwort because the juice of the plant forms lather in water; also called ragged robin.
- Boundaries**, how determined S-331
- international law I-109
- "Bounty" mutiny P-8
- Bouquet** (bū-kā'), Henry (1719-65), British soldier; given command of southern department of America; saved Fort Pitt: P-117
- Bourassa** (bū-rā-sā'), Henri (born 1868), French-Canadian journalist and legislator, leader of Quebec Nationalists; Dominion House of Commons 1896-1935; editor *Le Devoir*.
- Bourbon** (būr'bōn, French būr-bōn'), House of, younger branch of French royal (Capet) family, figuring in history from 9th century and occupying various European thrones after 16th century: B-207. For list of Bourbon rulers of France and Spain, *see in Index* France, history of; Spain, history of
- France: Henry IV first Bourbon H-279
- Naples and Sicily S-140
- Spain S-230-1
- Bourbon**, island in Indian Ocean. *See in Index* Réunion Island
- Bourdelle** (būr-dēl'), Émile Antoine (1861-1929), French sculptor, born Montauban, France; a favorite pupil of Rodin's; works are monumental, rugged, and powerful ('Heracles, the Archer'; portrait busts of Beethoven, Rodin, and Anatole France; 'Virgin of Alsace' and other war memorials): S-62
- Bourdon** (būr-dōn'), Eugène (1808-84), French engineer, inventor of pressure measuring instruments used for steam gauges and barometers: B-50
- Bourgeois** (būr-zhūwā), Léon Victor Auguste (1851-1925), French statesman, born Paris; in chamber of deputies almost continuously after 1888; six times in cabinet; premier 1895-96; helped draft Covenant of League of Nations and strong advocate of League; won Nobel peace prize, 1920.
- Bourgeois** (būr-gōis'), a type T-172
- 'Bourgeois Gentilhomme, Le' (lū būr-zhūwā' zhān-tē-yōm') (The Tradesman Turned Gentleman), comedy

ū=French u, German ü; gem, go; thin, then; ñ=French nasal (Jean); zh=French j (j in azure); κ=German guttural oh

- by Molière (1670); M. Jourdain, common elderly tradesman, suddenly wealthy, makes himself ridiculous by his efforts to acquire the education and manners of a courtier.
- Bourgeoisie** (*bqr-zhwa-zé*'), French term applied to people of the middle class C-324d
- Bourgeoys, Marguerite** (1620-1700), Canadian Roman Catholic nun, born Troyes, France; 1653 emigrated to Canada and founded at Montreal a religious order, the congregation of Notre Dame.
- Bourges** (*bqrzh*'), France, historic city, manufacturing and trade center 125 mi. s. of Paris; pop. 50,000; magnificent cathedral.
- Bourget** (*bqr-zhé*'), Paul Charles Joseph (1852-1935), French novelist, dramatist, and critic; brilliant analyst of human mind and soul; strong, simple, artistic style ('The Disciple'; 'The Gaol'; 'The Night Cometh'); F-198
- Bourinot** (*bq-ré-nó*'), Sir John George (1837-1902), Canadian historian and writer on political science ('Manual of Constitutional History'; 'Canada under British Rule').
- Bournemouth** (*bôrn'máth*'), England, watering place and winter resort 22 mi. s.w. of Southampton; pop. 117,000; map E-270a
- Bourse** (*bôrs*'), in Europe, a stock exchange or money market; from medieval Latin *bursa* ("purse").
- Boutet de Monvel** (*bq-té' dū mōn-vél*'), Louis Maurice (1851-1913), French genre and portrait painter and illustrator, born Orléans; did series of illustrations depicting the life of Joan of Arc; planned murals on this subject for church at Domrémy, but only one was completed (now in Art Institute of Chicago) as illustrator L-108, L-158
- Bouts** (*bouts*'), Dirk, or Dierick (1400?-75), Flemish painter, worked chiefly in Louvain; introduced new relations of light and color; master at portraying facial expression; surfaces of paintings enamel-like ('Entombment'; 'Pieta'; 'Moses and the Burning Bush').
- Boutwell, George S.** (1818-1905), American statesman, born Brookline, Mass.; first U. S. commissioner of internal revenue 1862; in Congress 1863-69; secretary of the treasury 1869-73; U. S. senator 1873-77.
- Boutwell, W. T.**, American missionary to Indians, chiefly Chippewa; in 1832 accompanied Henry Schoolcraft in search of source of Mississippi River; found Lake Itasca.
- Bouvet de Lozier** (*bq-vé' dū lōz-yā*'), Jean Baptiste Charles (1705-88), French explorer under French East India Co.; first to reach Antarctic ice pack
- Bouvet Island** A-217, map A-214
- Bouvines** (*bq-vén*'), France, village 7 mi. s.e. of Lille; scene of victory of Philip Augustus of France over the excommunicated Otto IV of Germany (1214).
- Bovidae** (*bô-vi-dé*'), family of hoofed, hollow-horned animals C-107
- Bow, England**, manufacturing town in center of Devonshire, famous for pottery.
- Bow**, of ship, the forward part of a ship, especially that part which curves around to the stem; also called bows.
- Bow**, of violin V-302
- Bow and arrow** A-254-5
- American Indian types**, picture I-67
- arrow-heads: how Indians made**, picture I-67; Stone Age, pictures S-293
- Assyrian**, picture B-6
- fishing with**, picture S-205h
- how to make** A-254
- Hundred Years' War** H-357, 358, pictures H-357, 359
- invention** M-48: effect C-244
- prehistoric drawings**, picture D-99
- types of bows** A-255: yew Y-206
- Bowditch** (*bou'ditch*'), Nathaniel (1773-1838), astronomer and mathematician, born Salem, Mass.; showed early aptitude for study, particularly mathematics, and at 17 taught himself Latin in order to read Newton's 'Principia'; acquired practical knowledge of navigation as supercargo and master on several merchant ships; famous for his book 'The New American Practical Navigator', published 1802, which after many revisions is still the standard authority of U.S. Navy.
- Bowdoin** (*bô'dū*'), James (1726-90), American statesman, born Boston; governor of Massachusetts 1785-87; suppressed Shays' Rebellion; Bowdoin College named for him; first president American Academy of Arts and Sciences.
- 'Bowdoin, The'**, MacMillan's ship, picture P-281
- Bowdoin College**, at Brunswick, Me.; men; nonsectarian; incorporated 1794; arts and sciences: H-248
- Longfellow at** L-192
- Bow drill**, making fire, picture M-87
- Bow'ell, Sir Mackenzie** (1823-1917), Canadian statesman, in Dominion House of Commons 1867-96, premier 1894-96, Conservative leader in senate 1896-1906.
- Bower**, room in a castle S-112
- Bower bird**, of Australia B-125
- Bowers, Claude Gernade** (born 1878), diplomat and historian, born Westfield, Ind.; ambassador to Spain 1933-39; ambassador to Chile since 1939; wrote distinguished histories ('Tragic Era'; 'Jefferson and Hamilton'; 'Jefferson in Power').
- Bowery, New York City** N-126
- origin of name** S-311
- Bowfin** (*bô'fin*'), a mudfish M-297
- evolutionary place** F-68
- Bowhead**, or Greenland right whale, a species of right whale, *Balaena mysticetus*, found in polar seas; length 50 to 65 ft.; head is one-third of total length; jaw highly arched; source of whale bone, oil.
- Bowie** (*bô'i*'), James (1799-1836), pioneer and soldier, born Burke County, Ga.; settled at San Antonio, Tex. 1828; became a Mexican citizen 1830; sided with the Americans in struggle against the Mexican government; captain of revolutionary forces at Nacogdoches 1832; colonel in 1835 campaign; killed defending Alamo: T-60
- Bowie, William** (born 1872), American engineer and geodesist, born Annapolis Junction, Md.; chief of Division of Geodesy, U. S. Coast and Geodetic Survey; authority on earth's crust, especially isostasy.
- Bowie knife** T-60
- Bowlders**. See in Index Boulders
- Bowles, Chester** (born 1901), advertising executive, born Springfield, Mass.; made head of Office of Price Administration October 1943, former general manager of OPA.
- Bowles, Samuel** (1826-78), American journalist, born Springfield, Mass.;
- editor *Springfield Republican*, which was founded by his father, Samuel Bowles (1797-1851); active in politics and early champion of woman suffrage; succeeded by his son Samuel Bowles (1851-1915).
- Bowline** (*bô'lin*'), a knot K-35, pictures K-34, 35
- Bowling**, an American game B-207
- in cricket** C-395
- Bowling Green, Ky.**, industrial city on Barren River, about 100 miles s.w. of Louisville; pop. 14,585; state teachers college; trade in horses, mules, hogs; shipping point for rock asphalt, white oolitic limestone; manufactures cut stone, evaporated milk, tobacco products; strategic point during Civil War: maps K-11, C-253
- Bowling Green**, small triangular park in New York City, at lower end of Broadway N-126
- in Jackson's time**, picture U-240
- Bowling Green State University**, at Bowling Green, Ohio; founded 1910; arts and sciences, business administration, graduate school.
- Bowls**, English game B-207
- Bowman, Isalah** (born 1878), social scientist, born Waterloo, Ontario; taught geography at Yale University, 1909-15; director, American Geographical Society, 1915-35; became president of Johns Hopkins University, 1935 ('Desert Trails of Atacama'; 'International Relations').
- Bow River**, in s. Alberta, Canada, tributary of the s. Saskatchewan; supplies water for irrigating thousands of acres of land; Calgary located at junction with Elbow River: map C-50b
- Bowsprit** (*bou'sprit*'), of ship S-119
- Bowstring hemp**. See Sansevieria
- Box'berry**, or wintergreen, a creeping evergreen plant W-114
- Box calf**, leather L-85
- Box elder**, a small to medium-sized tree (*Acer negundo*) of the maple family frequently cultivated for ornament or shade; also called ash-leaved maple; only American maple with compound leaves.
- Boxer**, a German dog D-82, picture D-84
- Boxer Rebellion**, in China (1900), against foreigners, led by fanatical secret society, the Boxers (colloquialism for translation of Chinese name, *I Ho Ch'uan*—"Patriotic Union of Fists"); C-221i
- Forbidden City** P-101
- Hoover in** H-334
- indemnity returned** C-221i
- Tientsin besieged** T-92
- Box family**, or Buxaceae (*büks-ä-sé-é*'), a family of plants, shrubs, and trees, including the common box, mountain spurge, and jayoba, or goat-nut.
- Boxing** B-208-212
- book about** H-313e
- champions and matches** B-208-212
- collegiate** B-212
- heavyweight champions** B-212
- history** B-208
- rules**, Marquis of Queensberry B-208
- tactics and blows**, pictures B-209
- terms explained** B-208
- Boxing Day** C-229-229a
- Boxing the compass**, in navigation C-326
- Box kite**, how to make K-26
- Box score**, baseball B-57, diagram B-56b
- Box tortoise** T-166
- foot**, picture F-147

Key—câpe, ât, fär, fâst, whät, fqll; mé, yét, fêrn, thére; ice, bit; rōw, wón, fôr, nôt, dq; cûre, bút, ryde, fqll, búrn;

Boxwood, an ornamental evergreen tree or shrub, much used for hedges; small, shiny, oval leaves; wood of light yellow color, valued for musical instruments and engraving: H-270
wood engraving on E-294

Boyce, William D. (1848-1929), Chicago publisher, big-game hunter, leader in Boy Scout movement; published *Saturday Blade* for farmers and *Ranger* magazine for boys ('Australia and New Zealand'; 'Africa, North, Tropical, South').

Boyce Thompson Institute for Plant Research, founded by William Boyce Thompson, opened 1924, at Yonkers, N. Y., for research on physiology and pathology of plants: P-245c

Boycott, Charles C. (1832-97), agent for Irish estates, driven out of Ireland (1880) through "boycotting" B-212

Boycott B-212

China C-221, n

Ireland B-212, P-81

labor disputes L-44c, B-212

Boyd, James (born 1888), American author, born Dauphin County, Pa.; has lived most of his life in North Carolina; 'Drums', novel of American Revolution, praised for originality, dramatic action; 'Marching On', story of Civil War; 'Bitter Creek', tale of pioneer life in the West.

Boyd, Thomas (1898-1935), American novelist, born Defiance, Ohio ('Through the Wheat'; 'Samuel Drummond'; 'Shadow of the Long Knives'; 'Light Horse Harry Lee').

Boyden, Seth (1785-1870), inventor and manufacturer, born Massachusetts; 1819 established first patent leather factory in U.S.; 1826 made first malleable iron; among other inventions were a process for manufacturing sheet iron and a hat-forming machine.

Boyesen (bōi'sēn), Hjalmar Hjorth (1848-95), American novelist and critic, born Norway; taught at Cornell 1874-80 and Columbia 1880 to his death ('Gunnar'; 'Ilka on the Hilltop'; 'Tales from Two Hemispheres').

Boyle, John J. (1851-1917), American sculptor, born New York City; especially renowned for portrayal of Indians ('The Stone Age'; 'The Alarm'; 'Savage Age'; 'Franklin'; 'Bacon'; 'Plato')
place in American art S-64

Boyle, Kay (born 1903), American novelist, short-story writer, poet, born St. Paul, Minn.; Guggenheim Fellowship (1934), O. Henry Memorial Award (1935); wrote with unconventional directness, frequently about people in a European setting ('Death of a Man', a novel; 'The White Horses of Vienna', short stories; 'A Glad Day', poems).

Boyle, Robert (1627-91), Irish scientist; son of the Earl of Cork; born in Dublin

Boyle's law G-18, P-193

founded modern chemistry C-178

Boyle's law G-18, P-193

Boylston, Zabdiel (1679-1766), American colonial physician, born Massachusetts; first to practise inoculation for smallpox in U.S. (1721); with Cotton Mather wrote pamphlets on inoculation.

Boyne (bōin) River, in eastern Ireland, rises in the Bog of Allen, flows into the Irish Sea; site of battle

of Boyne (1690) in which William III was victorious: I-127

Boys, Sir Charles Vernon (born 1855), English physicist; invented machine for weighing earth; Fellow, Royal Society
lightning camera L-135

Boys' and girls' clubs and organizations. See in *Index* Boy Scouts; Camp Fire Girls; Four-H Clubs; George Junior Republic; Girl Scouts; Junior Red Cross

Boys' Brotherhood Republic, self-governing club for boys between the ages of 14 and 18. First club organized in Chicago 1914, by Jack Robbins; another in New York City 1931, by Harry Slonaker, a member of the Chicago group. Stresses community responsibility and crime prevention. Group governed as a city-state with officers elected by the "citizen" members.

Boy Scouts B-213-18

admission: applying for B-214; requirements for B-215

aims, citizenship, and service B-213

badges and medals B-216-17

books that are useful B-218

camping C-42-47b, pictures B-215, 216, C-45

child development, place in C-202

Cubs, organization B-217

headquarters, securing B-217

history of movement B-217-18

law B-214

Lone Scouts B-217

motto B-213

oath B-214

officers B-217

organizing a troop B-214

rank, requirements for B-215-17

rural communities B-217

scholarships awarded B-214

Sea Scouts and Explorer Scouts B-217, 214

signal codes S-143, picture S-142

training, what they learn B-213

uniform and equipment B-217, picture B-213

World War (1914-18) B-213-14

Boys' Festival, in Japan J-194, picture J-194

Boys' States, American Legion A-176
Boys Town, Neb., home for boys, 10 mi. w. of Omaha, incorporated as a village in 1936; pop. about 250; started and managed by a Roman Catholic priest, Father Edward Joseph Flanagan; supported by private contributions. See also in *Index* Flanagan, Edward Joseph
'Boy's Town', story by William Dean Howells H-347

'Boy with the Red Vest', painting by Cézanne, picture P-26

Boz (bōz), pen name sometimes used by Charles Dickens D-66

Bozeman (bōz'mān), Mont., farming center 75 mi. s.e. of Butte; pop. 8665; Montana State College of Agriculture and Mechanic Arts; U.S. Hatchery: map M-243

Bozen (bōt'sēn), Italy. See in *Index* Bolzano

Bozzaris (bōt'sū-rēs or bō-zār'is), Marcos (1788?-1823), the "Leonidas of modern Greece," hero of Greek war of independence; killed at Missolonghi, as told in Fitz-Greene Halleck's poem 'Marco Bozzaris'.

'Brabançonne, La' (brā-bān-sōn'), Belgian national air N-25

Brabant (brā'bānt, French brā-bān'), medieval duchy of Netherlands; now divided into North Brabant (Netherlands) and Antwerp and South Brabant (Belgium).

Braccio (brāk'kō), Roberto (1861-1943), Italian dramatist; most of

plays psychological studies of unhappy love ('The Little Saint'; 'Phantasms'): D-96

Brace, a leverage tool T-110, picture T-110a

Bracelet, a piece of jewelry G-25

Brachiopoda (brāk-i-ōp'ō-dā), or lamp shells, bivalve worms W-180b, S-107, picture S-109
classified Z-227

Brachycephalic (brāk-i-sēf-āl'ik), "short-headed," term in anthropology R-10

Brachycome (brā-kik'ō-mē), a genus of plants native to Australia. See in *Index* Swan River daisy

Brack'en, a type of fern F-26, picture F-24

Brackenridge, Hugh H. (1748-1816), American jurist and writer, born in Scotland, emigrated to Pennsylvania; classmate of James Madison at Princeton; chaplain in Revolutionary army; author of satire, 'Modern Chivalry'.

Bract (brākt), the small, sometimes scalelike, leaves in a flower cluster, rarely noticed. When they develop into large leaves, as in the case of the pulpit of the Jack-in-the-pulpit or the scarlet bracts of the poinsettia, they are strikingly visible.

Bradbury, John, Scottish naturalist; during 1810-11 traveled up the Missouri River: N-165

Brad'dock, Edward (1695?-1755), British general, defeated and slain during French and Indian War F-194

Daniel Boone accompanies B-192

Washington aide-de-camp to W-15

Braddock, James J. (born 1905), American boxer; born North Bergen, N. J.; world's heavyweight champion 1935-36: B-212

Braddock, Pa., steel-manufacturing borough on Monongahela R. 10 mi. s.e. of Pittsburgh; pop. 18,326; scene of Braddock's defeat.

Bradford, Andrew (1686-1742), American printer and publisher; published in 1719 the first newspaper in Pennsylvania, *American Weekly Mercury*; published in 1741 the first magazine in America, *American Magazine*; served a prison term for printing essays criticizing the Provincial Council: M-27

Bradford, Gamaliel (1863-1932), American man of letters, born Boston, Mass.; noted for vivid and searching character portraits or "psychographs" ('American Portraits'; 'Damaged Souls'; 'Darwin'; 'D. L. Moody—A Worker in Souls'; 'As God Made Them—Portraits of Some Nineteenth-Century Americans').

Bradford, Roark (born 1896), American author, born Lauderdale County, Tenn.; journalist in Atlanta and New Orleans until 1926; short stories and novels of Negro life; 'Child of God' won O. Henry Memorial Award (1927); 'Ol' Man Adam and His Chillun', Bible tales, inspired Marc Connelly's play 'The Green Pastures'; 'John Henry', a gripping popular novel.

Bradford, William (1590-1657), American colonial governor and historian; born Austerfield, Yorkshire, England; joined Separatists at age of 17; imprisoned for attempt to leave England, but finally reached Holland; sailed on *Mayflower*; for 30 years governor of Plymouth Colony, whose success was due chiefly to him: P-261
writings A-176; quoted M-91, 92

Bradford, William (1663-1752), American printer and newspaper publisher, born Leicester, England; set up first printing press in Philadelphia in 1682; established (1752) the *Gazette*, first newspaper published in New York.

Bradford, England, city in Yorkshire, 30 mi. n.e. of Manchester; pop. 298,000; famous woolen mills; noted for municipal ownership of markets, waterworks, street railways: map E-270a

Bradford, Pa., industrial and railroad city 65 mi. s. of Buffalo, N. Y.; in oil and natural gas fields; paper boxes, cutlery, furniture, brick; pop. 17,691: map P-112

Bradlee-Doggett house, picture A-168

Bradley, Omar N. (born 1893), U.S. Army officer, born Clark, Mo.; military strategist; commanded victorious drive of U.S. 2d Corps into Bizerte, Tunisia, May 1943.

Bradley Polytechnic Institute, at Peoria, Ill.; founded 1897; arts and sciences, horology, music, fine and applied arts.

Bradstreet, Anne (1612-72), American poet, born Northampton, England; wife of Simon Bradstreet; first woman writer in American Colonies; idolized by her contemporaries; 'Contemplations' is considered her best poem.

Bradstreet, Simon (1603-97), colonial governor of Massachusetts (1679-86, 1689-92); born Lincolnshire, England; generally popular, but opposed by majority of colonists for the mildness and toleration he displayed during the first witchcraft persecutions.

Brady, Cyrus Townsend (1861-1920), American clergyman and author, born Allegheny, Pa. ('American Fights and Fighters'; 'Under Tops'ls and Tents').

Brady, Matthew B. (1823-88?), American photographer, born Cork, Ireland; followed Union army in campaigns; developed plates in wagon fitted as dark room example of work C-252

Braga (*brä'gä*), Theophilo (1843-1924), first president of the Portuguese republic 1910-11; poet, scholar, and professor.

Braga, Portugal, ancient capital of Lusitania; archbishop of Braga is Portuguese primate; thousands make annual pilgrimage to the Church of Bom Jesus do Monte; pop. 27,000.

Braganza, or Bragança (*brä-jän'sä*), House of, the reigning family of Portugal 1640-1910, and of Brazil 1822-89.

Bragdon, Claude (born 1866), architect, born Oberlin, Ohio; designer of stage productions; wrote on architecture and theosophy.

Bragg, Braxton (1817-76), Confederate general, born Warren County, N. C.; served in Seminole and Mexican wars; defeated Rosecrans at Chickamauga; defeated by Grant at Chattanooga

invades Kentucky C-255
Missionary Ridge defeat C-157
Murfreesboro F-193

Bragg, Edward Stuyvesant (1827-1912), American politician and congressman, born Unadilla, N. Y.; brigadier general in Civil War; in Congress eight years; seconded Cleveland's nomination (1884), saying, "We love him for the enemies he has made."

Bragg, Sir William Henry (1862-

1942), English scientist; director of Royal Institution and of Davy-Faraday research laboratory; researches on radioactivity; received 1915 Nobel prize in physics (in conjunction with his son William Lawrence) for work on X-rays and crystals: C-173, C-409, X-200

Bragg, William Lawrence (born 1890), British physicist, born Australia; son of Sir William Henry Bragg; professor physics, Victoria University, Manchester, 1919-38; appointed Cavendish professor of physics, Cambridge University, 1938; shared Nobel prize 1915 for work done with father on X-rays and crystal structure: C-173, X-200

Bragi (*brä'gē*), god of poetry in Norse mythology S-37, 38

Brahe (*brä'hē*), Tycho (1546-1601), Danish astronomer; created new epoch in astronomy by improvements in astronomical observation Kepler and K-14

Brahma (*brä'mä*), Hindu god B-218, H-293

Brahma, a breed of poultry P-338, picture P-337

Brah'manas, sacred writings of Hindus I-41, H-293

Brah'manism H-293, I-38

temple dancer, picture A-329

Brahman ox, or zebu Z-216, C-102

brahman cattle in U. S. C-105

Brahmans, priestly caste of Hindus H-293

caste system I-36

costume, picture I-38

education privileges E-166

sandalwood caste-mark S-23

Brahmaputra (*brä-mä-pg'trä*) River, India; rises in Tibet and flows e. 800 mi., then bending s. breaks through the Himalayas and flows s.w. to Ganges 1800 mi.: I-31, G-5, map I-30

in Tibet T-39

Brahmin, old way of spelling Brahman; term now used ironically to indicate a person of superior culture.

Brahms (*bräms*), Johannes (1833-97), German pianist and composer B-218-19, M-314

Brail, in falconry F-7

Braila (*brä-älä*), Rumania, important Danube port 105 mi. n.e. of Bucharest; pop. 62,000; former Turkish fortress; seized by Germans 1916; sulphur springs; exports grain, timber, petroleum: map E-326e

Braille (*brä'yü*), Louis (1809-52), French educator and organizer, inventor of braille (*bräl*) system of printing for the blind B-156-7

Braille alphabet B-156-7

Brain B-219-24. See also in Index

Psychology

cells B-220, 222

convolutions, picture B-220

cortex B-220-1, picture B-222

develops in early childhood C-198

gray matter B-220, picture B-222

hypnosis, condition of H-378

injuries and diseases B-220, 223-4

insects I-87

man's compared with: ape A-225-6;

other animals B-219, 220, 221

nature of reactions B-222-3

nerve fibers N-64-5, B-220, 222-3

parts of B-219-20, pictures B-220, 222

phrenology P-186

prehistoric animals F-163

primitive man M-46

seat of the mind M-181

sensory areas B-220-1. See also in Index

Senses

size, table B-219
sleep and dreams S-162-3
structure B-219-20
weight, table B-219
white matter B-220

Brainerd, David (1718-47), missionary to the Indians of Massachusetts, Delaware and eastern Pennsylvania; born Haddam, Conn.; left diary which is incorporated in Jonathan Edwards' account of his life.

Brainerd, Minn., city on Mississippi River, 110 mi. n.w. of St. Paul; pop. 12,071; gateway to lake and resort region; railroad shops; lumber, paper; agriculture and dairying; in Cuyuna iron range: map M-192

Brain'tree, Mass., town 10 mi. s. of Boston; granite-quarrying, metal-working; pop. 16,378; settled 1634.

"Brain trust" R-146e

Braithwaite, William Stanley (born 1878), American Negro poet, critic, and anthologist, born Boston; works mystic in tone; unrelated to race ('Lyrics of Life and Love', 'Sandy Star', poems; 'Trost on the Green Leaf', short stories).

Brake, a type of fern F-26

Brakes B-224-5

airplane A-79-80

automobile A-394, 403: safety in

using S-2i

elevator E-250

Bra'mah lock L-176

Bramante (*brä-män'tä*), Donato (1444-1514), great Italian Renaissance architect, employed by Pope Julius II to reconstruct Vatican and St. Peter's.

Bramble, English name for blackberry B-152

Brán, flakes from coarse outer hull of wheat or other grain
corn C-368, diagram C-366b
in bread, food value B-231-2
in flour-milling F-118, 119

Branch banking B-44

Brancusi (*brän-cg'zē*), Constantin (born 1876), Rumanian sculptor of modern school; his works consist largely of abstract sculptural forms based on the oval; mediums include marble, stone, metal, and wood ('Bird in Flight'; 'The Kiss') place in modern art S-62

Brand (*bränd*), or Brandt, Hennig, 17th-century German physician and chemist, discoverer of phosphorus.

Brand, cattleman's mark of ownership C-109, picture C-110

Brandeis (*brän'dis*), Louis D. (1856-1941), American jurist, born Louisville, Ky., of Jewish family; graduated Harvard Law School; people's counsel in many important cases involving social welfare; associate justice of U. S. Supreme Court 1916-39; authority on interstate commerce questions and a champion of Labor; author of 'Other People's Money', 'Business a Profession', and articles on labor problems, railroads, trusts, Zionism, and Jewish problems.

Brandenburg (*brän'den-burk*), province of central Prussia; 15,070 sq. mi.; pop. 2,590,000: map G-66
Berlin-Köln capital B-99a
nucleus of Prussia P-358, P-359

Brandenburger Gate, Berlin B-99, picture B-99b

Brandes (*brän'dēs*), Georg Morris Cohen (1842-1927), Danish literary critic of Jewish descent; taught and lectured for many years in Copenhagen; brilliant and advanced

- criticism caused much controversy during early career, but he is now considered one of greatest of critics and his 'Main Currents in 19th Century Literature' ranks as a classic ('William Shakespeare'; 'Wolfgang Goethe').
- Brandon, Manitoba**, 2d largest city of Manitoba, on Assiniboine River 125 mi. w. of Winnipeg; pop. 16,461; flour, leather goods, farm implements, engines; annual agricultural exhibit and stock show; Brandon College, normal school: map C-50b
- Brandt (bränt)**, Georg, or Georges (1694-1768), Swedish chemist, discoverer of cobalt; did research on salt, soda, and saltpeter.
- Brandy**, a liquor A-112
- Brandywine**, former village, now part of Wilmington, Del. W-105
- Brandywine River**, or Brandywine Creek, tributary of Delaware River in Pennsylvania and Delaware; scene of battle in Revolutionary War (Sept. 11, 1777) in which Howe defeated Washington, leaving way open to Philadelphia: D-40b, map D-40
- Lafayette** at battle L-54
- Brang'wyn**, Sir Frank (born 1867), English painter, etcher, and illustrator, born Bruges, Belgium; noted for rich coloring and decorative quality of his work; has executed some notable murals.
- Branly (brän-lé')**, Édouard (1844-1940), French scientist, inventor of coherer for wireless, one of the first successful devices used as a detector of wireless signals.
- Brant, Joseph (Thayendanegea)** (1742-1807), Mohawk Indian chief; educated Eleazar Wheelock's Indian school; life-long member Episcopal church; translated English Prayer Book into Mohawk language; aided British in Revolutionary War (Cherry Valley Massacre) but after the war strove for peace between colonists and Indian tribes; one of the great Indians.
- Brant**, a kind of goose G-120
- Brantford, Ontario**, city 60 mi. s.w. of Toronto on Grand River; pop. 30,107; machinery, clothing; named for Joseph Brant; here Alexander Graham Bell perfected telephone: map, inset C-50b
- Branting, Hjalmar** (1860-1925), first Socialist prime minister of Sweden 1920, again 1921; Nobel peace prize 1921; leading advocate Wilson peace program and League of Nations.
- Bras d'Or (brä dör)** lakes, on Cape Breton Island C-80
- Brasenose College**, Oxford O-260, picture O-259
- Brashear, John Alfred** (1840-1920), American astronomer and manufacturer, born Brownsville, Pa.; constructed and manufactured instruments of great importance to astronomy and physics.
- Braşov (brä-shôv')**, Rumania, also Kronstadt, city 85 mi. n.w. of Bucharest; pop. 42,000; commanded by Schlossberg citadel; "Black Church" (14th century); metal and wood manufactures: map E-326e
- Brass**, an alloy of copper and zinc C-360-1, A-131-2, Z-217
- ancient use Z-217, P-219
- artistic uses C-361, M-124, pictures C-357, 360, 361
- Connecticut C-335
- industrial uses C-360, 357
- manufacturing processes C-360
- medieval use M-123, C-361
- metal working M-123, 124-5: American colonial, picture M-124
- military uses Z-217
- paint P-32
- pins P-219
- Brasses**, a group of musical instruments O-241, M-323, H-338-9
- Brassicaceae (bräs-i-kä'sé-é)**, cabbage family C-2-3
- Brasstown Bald Mountain**, in northern Georgia, highest point in state (4768 ft.).
- Bratianu (brät-é-än'g)**, family of powerful Rumanian politicians, including Ion C. (1821-91), premier 1876-88; Ion (1864-1927), who dominated Rumanian affairs most of life, being practical dictator after 1922; Vintila (1867-1930), minister of finance 1922-26 and premier 1927-28.
- Bratislava (brät-lé-slä-vä)** (German Pressburg), cap. of German protectorate of Slovakia; on Danube River 35 mi. e. of Vienna; pop. 145,000; cap. of Hungary 1541-1784; varied manufactures; farm trade: maps G-66, C-422
- Brattleboro, Vt.**, village on Connecticut River in s.e. of state; pop. 9622; pipe organs, wooden toys, granite memorials; chartered 1753: V-287, map N-86
- Brauchitsch (brouk'ich)**, Walther von (born 1881), German general; served in 1st World War; commander in chief in 2d World War until removed by Hitler Dec. 1941.
- Brauer, Adrian**. See Brouwer
- Brawley, Calif.**, city 95 mi. e. of San Diego; pop. 11,718; shipping point for fruit, vegetables, and live stock; cotton gins, grain mills.
- Braxton, Carter** (1736-97), signer of Declaration of Independence; born Newington, Va.; delegate from Virginia to Continental Congress.
- Bray, Thomas** (1656-1730), English clergyman, philanthropist, writer; active in religious, educational, other benevolent works: L-106a
- Brazil'**, United States of, republic of South America; 3,286,000 sq. mi.; pop. 43,000,000; cap. Rio de Janeiro: B-225-8, maps B-226, S-208b-c, d, Outline S-211
- agriculture B-226-226a, c, d: cotton, map and chart C-379
- Amazon region A-139-40, B-225, 226b, maps A-139, S-208d
- art and music B-227
- cities B-227, list B-225. See also in Index names of cities
- climate and rainfall B-226, 226b, c, S-205f, h, map S-208d
- coffee C-295-8, B-226, 226a, d, 227
- commerce B-226d, table C-480
- communication B-226d-27
- education B-226c-d
- flag F-94, color plate F-88: of empire F-100, color plate F-90
- Florianopolis Bridge, table B-342
- forests B-226b, map S-208d
- government B-228
- history B-227-8, S-208l: Cabral discovers A-142; Magellan reaches A-144; Huguenot colony A-145
- Independence Day H-323
- jungles B-226b, c
- language B-226c
- literature L-67u, s, B-227
- manufacturing B-226d
- minerals B-226a, d: amethyst G-28; diamonds D-59-60, picture B-226a; gold G-111; iron ore I-138; manganese deposit, picture S-208; rare earths G-23; tourmaline G-29
- name, origin of B-226b
- national song N-27
- natural features B-225, S-208g-h, maps B-226, S-208d
- people B-226c: racial mixture L-67f
- plants and animals A-139-40: butterfly, color plate I-87a-b
- population B-225, 226c, map S-208d
- products B-226-226a, 226b, c, d, list B-225, pictograph S-204
- religion B-226d
- Rio de Janeiro R-108-9, pictures L-67a
- T. Roosevelt's explorations R-152
- rubber R-164, 165, 166, B-226b, 227, picture B-226c
- shelter B-226b
- transportation B-226d-27
- vegetation B-226a-b, map S-208d
- Brazilian cotton** C-382
- Brazilian Highlands** S-208g-h, 205f, map S-208d
- Brazil nut**, or pará nut N-187
- Brazilwood**, or dyewood, product of several species, especially *Pernambuco wood (Caesalpinia echinata)*; wood is usually ground to sawdust and then treated with water or alcohol to release coloring matter: B-226b
- Brazing solder** A-132
- Brazos (brä'zôs)** River, in e. cent. Texas, flows s.e. 950 mi. to Gulf of Mexico; navigable for about 200 mi.: map T-56
- Brazzaville (brä-zä-vél')**, capital of Middle Congo and of French Equatorial Africa; river port on Stanley Pool of Congo River; connected by railroad with Pointe Noire on the coast; pop. 40,000: map A-42a
- Bread** B-228-32
- bakery production B-229-31
- baking powder B-15
- barley B-47
- colloidal texture C-303
- consumer protection B-232
- corn P-221d
- earliest record, Stone Age B-228
- farmer to consumer, picture E-151
- flour F-117-20
- food value B-231-2, chart F-144b
- how to judge quality B-232
- ingredients, what they do B-229
- leavened bread B-229
- national varieties B-228
- Pompeian bakeries P-301
- pounds per bushel of flour F-120
- prepared doughs and mixes B-229
- rye R-202
- unleavened bread B-229: ceremonial use P-85
- vitamins B-231-2
- wheat W-81, 84
- whole wheat, or graham F-119, B-229: food value B-231-2
- yeast Y-204-5
- Bread and Butter State**, popular name sometimes given to Minnesota.
- Breadfruit**, tree of Pacific islands B-233
- "Break bone fever" M-268
- Breaker**, in coal mining M-188
- Breakfast cereals** B-233-4
- irradiation H-371
- Break rolls**, in flour-milling F-118-9, picture F-119
- Breakspere, Nicholas**. See in Index Adrian IV
- Breakwater**, a solid barrier built out into sea or lake to protect a harbor from strong waves; differs from jetty in that purpose is chiefly protection, while purpose of jetty is primarily to direct course of stream and force it to carry its sediment into deep water: H-216. See also in Index Embankment; Jetty
- Bream**, name given to several species of both fresh- and salt-water fish in different localities. In fresh water the name is applied to members of

ü=French u, German ü; gem, ðo; thin, then; ñ=French nasal (Jean); zh=French j (z in azure); k=German guttural ch

- the sunfish and roach families. Salt-water breams are usually members of the porgy family.
- Brearly, David** (1745-90), American jurist and statesman, born Spring Grove, N. J.; chief justice of Supreme Court of N. J.; delegate to Constitutional Convention.
- Breasted** (*brēs'tēd*), **James Henry** (1865-1935), Orientalist and historian, one of greatest authorities on Egypt; born Rockford, Ill.; professor Egyptology and Oriental history, chairman Department of Oriental Language, and director Oriental Institute, University of Chicago; conducted archeological expeditions in Egypt, Mesopotamia, Palestine, Persia ('A History of Egypt'; 'Ancient Times'; 'Conquest of Civilization'); picture M-121
- Breast stroke** S-345, pictures S-347
- Breast wheel**, a water wheel W-51
- Breath**, holding R-79
- Breathing R-79-80. See also in Index** Respiration correct in swimming S-345
- Brébeuf, Saint Jean de** (1593-1649), Canadian Jesuit missionary and martyr, born Condé-sur-Vire, France; went to Canada with Champlain 1625; worked among Huron Indians 1626-29 and 1633-49; tortured and murdered by Iroquois; canonized 1930.
- Breccia** (*brēch'i-ā*). See in Index Conglomerate rock
- Breck, George William** (1863-1920), American painter, born Washington, D.C. (murals, Univ. of Va.).
- Breck, Samuel** (1771-1862), American patriot; son of a prominent Boston family; adopted Philadelphia as his native city; bitter opponent of slavery; served 1817-21 in Pennsylvania senate.
- Breck'inridge, John Cabell** (1821-75), American politician and soldier, born near Lexington, Ky.; vice-president under Buchanan; Confederate general and secretary of war in Confederacy presidential candidate D-87
- Breda** (*brā-dā'*), Netherlands, town 26 mi. s.e. of Rotterdam; pop. 44,000; once important frontier fortress, repeatedly taken by Spanish and French; residence of Charles II during exile: map B-87 'Surrender of Breda', painting by Velasquez, picture P-18
- Bredius** (*brā'dē-ūs*), **Abraham** (born 1855), Dutch art connoisseur and art historian; was director Royal Pictures Cabinet (Mauritshuis) at The Hague ('Jan Steen'; 'Künstler Inventare'; 'Torrentius').
- Breeches**, a garment D-107, 109
- "Breeches Bible"** B-105
- Breeches-buoy**, life-saving device L-123
- Breech-loading gun** F-50, pictures F-49, A-322
- Breeding**, animal A-51-3
- Bureau of Animal Industry U-228
- cattle C-102, 103-6; dairy D-2, C-104-5
- dogs D-81
- goldfish C-115
- hinny H-345
- hog H-315-16, pictures A-52, H-315
- horses H-342-5
- live stock types, picture A-52
- mules H-345
- poultry P-336-9
- principles: Bakewell's C-103; Mendel's H-284
- registration of breeds and types A-54
- sheep S-105-6, W-140, A-53
- Breeding**, plant P-245d-e, B-203. See also in Index Plant improvement
- Breed's Hill**, elevation near Bunker Hill B-271
- Breeze**, a gentle wind W-112, 113
- Bręge** (*brā'gū*) River, in s. Germany, source of Danube D-13
- Breitenfeld** (*brī'tēn-fēlt*), Germany, village in Saxony 5 mi. n. of Leipzig; Swedish victories (1631, 1642) in Thirty Years' War Gustavus Adolphus at G-190
- Bremen** (*brēm'ēn*, German *brā'mēn*), state in Germany; 99 sq. mi.; pop. 400,000; cap. Bremen: B-234
- Bremen**, one of the leading seaports of Germany; on Weser River 45 mi. from its mouth, pop. 345,000; B-234, maps G-66, E-326d in Hanseatic League H-212
- Bremer** (*brām'ēr*), **Fredrika** (1801-65), Swedish novelist and women's rights advocate ('Sketches of Every-Day Life'; 'The H. Family'; 'Axel and Anna'; 'Hertha').
- Bremerhaven** (*brām'ēr-hā-fēn*), Germany, seaport on Weser estuary 35 mi. n.w. of Bremen; pop. 24,000; shipbuilding: B-234, map G-66
- Bremerton**, Wash., city on Puget Sound 15 mi. w. of Seattle; pop. 15,134; Puget Sound Navy Yard (established 1891, builds and repairs all classes of naval vessels); truck farming, dairying, fruit growing, lumbering.
- Brendan, Saint** (484-577), Irish abbot, called "the Voyager," patron of sailors; supposed to have discovered a beautiful land by sailing west; festival May 16.
- Bren'er Pass**, lowest pass over Alps (4500 ft.); railway opened in 1867: T-175, map A-381, picture I-155
- strategic importance T-176: Trent T-137
- Brennestone**, old name for. sulphur S-323
- Brennus** (*brēn'ūs*), chief of Gauls; led sack of Rome in 390 B.C.
- Brent, Margaret**, pioneer in women's rights movement; came from England to Maryland 1636: W-132
- Brereton, Lewis Hyde** (born 1890), Army officer, born Pittsburgh, Pa.; pioneer in army aviation; led U.S. army air forces in Philippines and India 1941-42; made commander U.S. army air force in Middle East July 1942; commander U.S. army forces in Middle East Feb.-Sept. 1943.
- Brer** (*brēr*) Fox, sly villain of Joel Chandler Harris' "Uncle Remus" stories F-134, 135
- Brer Rabbit**, hero of Joel Chandler Harris' "Uncle Remus" stories; outwits Brer Fox F-134, 135
- Brescia** (*brā'shā*), Italy, ancient city at foot of Alps, 52 mi. e. of Milan; pop. 130,000; fine Roman remains; firearms, textiles, paper: map I-156
- Breshkhovskaya** (*brēsh-kōf'skū-yā*), **Katerina** (1844-1934), Russian social worker; called "Grandmother of the Revolution"; of aristocratic parentage; exiled to Siberia; opposed to Bolshevism; in later years conducted schools ('Hidden Springs of Russian Revolution').
- Breslau** (*brēs'lau*), Germany, cap. of Prussian Silesia, on Oder River; pop. 625,000; university; textiles, machinery; trade in grain, live stock, metals, coal, timber: map G-66
- Breslau, Peace of** (1742), closed first Silesian War; Austria forced to grant Silesia to Frederick the Great, of Prussia.
- Brest**, France, seaport of Brittany; pop. 80,000: B-234, map F-179
- Plougastel Bridge B-240b
- Brest-Litovsk** (*brēs't-lē'tōf'sk*), Poland, fortified town on Bug River 120 mi. e. of Warsaw; pop. 29,000; railroad and manufacturing center; taken by Germans after long resistance in 1915, by Russia 1939, and again by Germany June 1941: W-157, map P-278
- Brest-Litovsk, Peace of** (1918), treaty between Germany and Russia W-160, R-190
- Bretagne** (*brū-tān'yū*), French name for Brittany. See in Index Brittany
- Brethren**, German Baptist. See in Index Dunkers
- Brethren**, Plymouth. See in Index Plymouth Brethren
- Brétigny** (*brā-tēn-yē'*), Treaty of (1360), in Hundred Years' War H-358
- Breton** (*brū-tōn'*), **Jules** (1827-1906), French painter; best known for gracious and skillful portrayal of French peasant life ('Song of the Lark', 'Return of the Gleaners'); also wrote poetry and prose.
- Breton Club**, origin of Jacobins J-181
- Bretonne**, Restif de la. See in Index Restif de la Bretonne
- Bretons**, people of Brittany B-248-9
- language C-124
- Brett, George Howard** (born 1886), U. S. Army officer, born Cleveland, Ohio; pioneer in military aviation; commander Air Forces of United Nations in s.w. Pacific, March-Aug. 1942; made commander of Caribbean area November 1942.
- Brett, William Howard** (1846-1918), librarian, born Braceville, Ohio; published the *Cumulative Index* (1896-1903), an index to periodicals; librarian, Cleveland Public Library, after 1884: L-106g
- Breuer, Josef** (1842-1925), physician of Vienna from whose early experiments grew the methods of psychoanalysis; collaborated later with Sigmund Freud.
- Breuer, Marcel** (born 1902), modernist architect and furniture designer, born Pécs, Hungary; research professor at Harvard after 1937.
- Breughel** (*brū'kēl*), **Jan** (1568-1625), Flemish artist, son of Pieter Breughel; called "velvet Breughel" because of smooth technique; painted flowers, landscape for canvases of Rubens who in turn painted figures in Breughel's landscapes ('The Garden of Eden').
- Breughel, or Brueghel** (*brū'kēl*), **Pieter the Elder** (1530?-70?), Flemish painter; noted for paintings of peasant life; two sons, Pieter the Younger (1564?-1637) and Jan (see above), were also celebrated painters.
- Brevet**, military commission giving honorary rank to an officer above that which he holds through his regular commission and for which he receives pay.
- Brevet medal**, U.S., a decoration of honor D-31
- Breviary** (*brē-vī-ār-ī*), book used in Roman Catholic church containing daily service for the canonical hours; usually divided into four volumes, one for each season of the year; includes psalms, lessons, antiphons, etc.; reading required of priests and all members of religious orders.
- Brevier** (*brē-vēv'*), type T-172
- Brewer, David J.** (1837-1910), Amer-

Key—cāpe, āt, fār, fāst, whqt, fāll; mē, yēt, fērn, thēre; īce, bīt: rōw. wōn. fōr. nōt, dō; cāre. bāt, rīde, fūll, bārn;

- ican jurist, born Smyrna, Asia Minor; exerted wide influence on public opinion and on development of law in U. S.; justice Supreme Court of Kansas, Supreme Court of U. S.; member Venezuelan Boundary Commission.
- Browster, Sir David** (1781-1868), Scottish scientist, discoverer of the laws of polarization of light kaleidoscope invented by K-1
- Brewster, William** (1567-1644), Pilgrim leader and one of founders of Plymouth B-234-5
- Brewster chair** A-170
- Brezina** (*bzhēz'ē-nā*), Otokar, pen name of Václav Jevavý (1868-1929), Czech poet; wrote symbolic and mystical verse ('The Music of the Springs'; 'Daybreak').
- Brian Boru** (*brī'ān bō-rū*), or **Brian of the Tribute** (926-1014), "high king" of Ireland 1002-14, slain after victory over Danes at Clontarf; figures in legend and history.
- Briand** (*brē-ān'*), Aristide (1862-1932), French statesman B-235
- Brian de Bois-Guilbert** (*bvā-jēl-bēr'*), knight in Scott's 'Ivanhoe'.
- Briard**, French herding dog D-82
- Briareus** (*brī-ā'rē-ūs*), in Greek mythology, giant son of Uranus U-261
- Briarwood**, root of heather H-263
- Brices Cross Roads**, national battlefield site in Mississippi; established 1929; Civil War battle.
- Brick** B-236-9, C-259-61
- adobe B-236
- houses S-113, N-96, *pictures* S-112, N-95, A-253
- ancient use B-236, A-257-8, S-111, *pictures* A-253, A-258, 260, B-236: Great Wall of China C-221h, *picture* C-209
- chromite C-230
- clay C-260, 261
- drains B-239
- dust used in cement C-128
- fire brick B-238, C-180, G-101
- gypsum G-190
- laying bricks, methods B-238
- lime in mortar L-138
- modern use B-238-9, *pictures* B-265, 266
- paving R-116, C-261
- production, machine vs. hand L-93a
- red color, reason for B-236
- refractories B-238, C-180, G-101
- sand S-23
- size B-238
- Spanish "azulejos" V-269
- special purposes, types B-238
- straw, why used B-236, C-260
- sun-baked brick B-236, A-251, *pictures* A-253, A-258, B-236, S-112
- America S-113
- Babylonia and Assyria A-257-8, B-5, 6
- Mesopotamia and Egypt S-111
- Stone Age ruins T-143
- terms used in brick-laying B-238
- terra cotta B-264, L-56, *pictures* B-265, 267
- Brick cheese** C-165
- Bricker, John W.** (born 1893), public official born Madison Co., Ohio; member Ohio Public Utilities Commission 1929-32; attorney general of Ohio 1933-37, elected governor for terms 1939-41, 1941-43.
- "Bricks without straw" B-236, C-260
- Brick tea** T-26
- Bridal Veil Falls**, in Yosemite Valley Y-207
- Bridal wreath** (spirea) S-259
- Bride, Saint.** See in *Index* Bridget
- "Bride of Lammermoor, The", novel by Sir Walter Scott, published 1819; heroine is timid, gentle, Lucy Ashton who loves Lord Ravenwood but is compelled to marry the Laird of Bucklaw; she becomes insane, stabs her husband on their wedding night, and dies
- "Lucia di Lammermoor" O-231
- Bride's well**, originally royal palace in London named from St. Bride's Well in vicinity; given to city of London as reformatory by Edward VI in 1553; in use for 300 years. Name now used for any house of correction for minor offenders.
- Bridge** B-239-43. See also in *Index* names of various bridges, and list of famous bridges on next page
- arched B-240: camel-back, China, *picture* C-221i; principle A-249, *pictures* B-243, I-125, I-165
- bascule B-240, *pictures* B-241, 243
- building B-239-40
- cantilever B-240, 240b, *pictures* B-240a, 241, 243
- concrete construction, reinforced B-240, *picture* B-243
- covered B-240
- girder B-240, *pictures* R-40, P-225
- jack-knife B-240, *picture* B-243
- longest bridges B-240b
- Nihon-bashi, Tokyo T-105
- noted bridges of world B-240b
- pontoon bridge B-240, P-135-6, *pictures* B-242, A-307a, S-71b
- strain: heat, wind, traffic B-240
- suspension B-240, 240b, *pictures* B-242, N-91, N-127, 129, A-374, D-56: wire cable, *picture* W-120
- trestle bridge B-240, 240b, *pictures* B-240, U-265
- vertical lift, *picture* B-240a
- wire cables W-121, *picture* W-120
- Bridgeman, William Clive, Viscount** (born 1864), British First Lord of the Admiralty; active in parliamentary affairs since 1889; secretary of mines; home secretary; created viscount 1929.
- Bridge of Sighs**, covered bridge in Venice; so called because condemned prisoners formerly passed over it from the judgment hall to place of execution V-278
- "Bridge of Ten Thousand Ages", China F-139
- Bridgeport, Conn.**, 3d city of state, on Long Island Sound; pop. 147,121: B-244, *map* C-336
- Bridger, James** (1804-81), American fur trader and scout, famed for daring and knowledge of Northwest; born Richmond, Va., later moved to St. Louis; in 1822 joined Ashley's expedition and continued in fur trade for 20 years; discovered Great Salt Lake 1824; built way-station, Fort Bridger, in s.w. Wyoming 1843; for many years a government scout.
- Bridges, Robert** (1844-1930), English poet, poet laureate (1913-30); at 38 abandoned medicine for literature; verse scholarly and of high quality with beauty and a serene joy in life the chief themes; 'The Testament of Beauty', his last work, published on 85th birthday, is a philosophical poem in 4 books ('Achilles in Scyros', 'The Christian Captives', poetic dramas; 'Milton's Prosody', criticism)
- work characterized E-289
- Bridges Creek, Va.**, early ancestral home of Washington W-13
- Bridget, Brigit, Brigid, or Bride, Saint** (452?-523?), one of the chief saints of Ireland; founded church and monastery of Kildare; festival February 1.
- Bridget of Sweden, Birgitta, or Brigitta, Saint** (1303?-73), founder of Brigittines, order of nuns, born near Uppsala, Sweden, of family famed for piety and wealth; patroness of Sweden; festival October 8.
- Bridgeton, N. J.**, port and manufacturing city on Cohansey River near Delaware Bay; pop. 15,992; glass, canning factories; important settlement in Colonial days: *map* N-90
- Bridgetown**, capital of Barbados, British W. Indies: pop. 13,000.
- Bridgewater Canal**, England C-68
- Bridging**, in wrestling W-183, *picture* W-182
- Bridgman, Laura Dewey** (1829-89), American blind deaf-mute B-156
- Brie** (*brē*), district of northern France between Seine and Marne rivers
- cheese C-165
- Brief**, in debating, *model* W-190-1
- Brienne-le-Château** (*brē-ēn' lū shā-tō'*), France, small town 23 mi. n.e. of Troyes on Aube River; indecisive battle between Blücher and Napoleon (1814); Napoleon studied at military school (suppressed 1790) Napoleon at N-5, *picture* N-6
- Brienx** (*brē-ēnts*), Lake, in Switzerland, in canton of Bern; expansion of Aar River; about 9 mi. long and 1½ mi. wide.
- Brier**, or briar, any thorny plant of the genus brambles (*Rubus*) or any wild-growing rose.
- Brieulles-sur-Meuse** (*brē-ūl' sūr-mūz*), French town on Meuse River, 15 mi. n. of Verdun; buttressed e. end of Hindenburg line; captured by American 3d Corps, Oct. 9, 1918; taken from French by Germans 1940.
- Brieux** (*brē-ū'*), Eugène (1858-1932), French dramatist noted for sensational treatment of social subjects; a reformer rather than a literary artist ('The Red Robe'; 'Damaged Goods'; 'L'Enfant').
- Brig**, ship S-119
- Nancy* W-105
- Brigach** (*brē-gāk*) River, in s. Germany; with Brege, source of Danube.
- Brigade**, in U. S. Army A-307b, c
- Brigadier General**, in U. S. Army, next above colonel and below major general
- insignia, *picture* U-178
- Brigantine**, ship S-119
- Briggs, Clare** (1875-1930), American cartoonist, born Reedsburg, Wis.; among his best-known series were 'Skin-nay', 'The Days of Real Sport', 'When a Feller Needs a Friend', 'Ain't It a Grand and Glorious Feeling', and 'Mr. and Mrs.'
- Briggs, Thomas Henry** (born 1877), American educator, born Raleigh, N. C.; professor at Teachers College, Columbia University, since 1912; author of books on teaching of English.
- Brigham Young University**, coeducational institution at Provo, Utah, founded and endowed, 1875, by Brigham Young; under control of the Latter Day Saints (Mormons); has collegiate, high school, and normal departments.
- Bright, Sir Charles Tilston** (1832-88), English engineer; helped lay first transatlantic cable: C-8
- Bright, John** (1811-89), English liberal statesman and brilliant orator, born Lancashire; a Quaker; lifelong friend and co-worker of

SOME OF THE WORLD'S MOST FAMOUS BRIDGES

(Listed in order of length of main span)

| NAME | LOCATION | TYPE | DATE OPENED | HEIGHT ABOVE WATER (FEET) | LENGTH OF MAIN SPAN (FEET) | TOTAL LENGTH (FEET) | COST |
|-------------------------------|--|---------------------------------|-------------|---------------------------|----------------------------|---------------------|--------------|
| Golden Gate | Golden Gate Strait, San Francisco | Suspension | 1937 | 220 | 4,200 | 9,127 | \$35,000,000 |
| George Washington Memorial | New York City-New Jersey (Hudson River) | Suspension | 1931 | 213 | 3,500 | 8,700 | 60,000,000 |
| San Francisco-Oakland Bay | San Francisco Bay via Yerba Buena Island to east shore | Suspension-cantilever-tunnel | 1936 | 200 | 2,310 | 43,560 | 77,200,000 |
| Ambassador | Detroit, Mich.-Windsor, Ont. (Detroit River) | Suspension | 1929 | 152 | 1,850 | 9,000 | ..... |
| Quebec | Quebec (St. Lawrence River) | Cantilever | 1917 | 150 | 1,800 | 3,240 | ..... |
| Delaware River | Philadelphia, Pa.-Camden, N. J. | Suspension | 1926 | 135 | 1,750 | 8,126 | 25,000,000 |
| Firth of Forth | Scotland (near Edinburgh) | Cantilever | 1890 | 150 | 1,710 | 8,098 | 16,000,000 |
| Kill Van Kull | Staten Island, N. Y.-Bayonne, N. J. | Steel arch | 1931 | 150 | 1,675 | 8,100 | 16,000,000 |
| Sydney Harbor | Australia (Sydney-North Sydney) | Steel arch | 1931 | 170 | 1,650 | 3,770 | 25,000,000 |
| Bear Mountain | New York (Hudson River near Peekskill) | Suspension | 1924 | 155 | 1,632 | 2,252 | 6,000,000 |
| Williamsburg | New York City (East River) | Suspension | 1904 | 139 | 1,600 | 7,308 | 24,188,090 |
| Brooklyn | New York City (East River) | Suspension | 1883 | 135 | 1,596 | 6,016 | 25,094,577 |
| Lions Gate | Canada (across Burrard Inlet, from Vancouver, B.C., to North Vancouver, B.C.) | Suspension | 1938 | 200 | 1,550 | 2,778 | 5,700,000 |
| Mid-Hudson | Poughkeepsie, N. Y.-Highland, N. Y. | Suspension | 1930 | 136 | 1,500 | 4,072 | 6,000,000 |
| Manhattan | New York City (East River) | Suspension | 1909 | 135 | 1,470 | 6,855 | 31,084,705 |
| Triborough | New York City (connects Manhattan, the Bronx, and Queens with bridges over East River, Harlem River, and Bronx Kills, and viaducts over Ward's Island, Randall's Island, and Little Hell Gate) | Suspension-lift span-truss span | 1936 | 135 | 1,380 | 12,320 | 60,300,000 |
| Mount Hope Bay | Rhode Island (Road to Newport) | Suspension | 1930 | 135 | 1,200 | 2,648 | 5,000,000 |
| Queensborough | New York City (East River) | Cantilever | 1909 | 135 | 1,182 | 7,449 | 17,591,762 |
| Florianopolis | Brazil (Island of Santa Catharina-Mainland) | Suspension | 1926 | 100 | 1,113 | 2,700 | ..... |
| Carquinez Strait | San Pablo Bay (San Francisco Bay) | Cantilever | 1927 | 150 | 1,100 | 4,700 | 8,000,000 |
| Montreal Harbor | Canada (St. Lawrence River) | Cantilever | 1930 | 155 | 1,097 | 8,817 | ..... |
| Cooper | Charleston, S. C. (Cooper River) | Cantilever | 1929 | 150 | 1,050 | 14,500 | 6,000,000 |
| Mapimi | Mexico (Ojuela River, Durango) | Suspension | 1900 | ... | 1,030 | ... | ..... |
| Hell Gate | New York City (East River) | Steel arch | 1917 | 135 | 1,017 | 17,868 | 15,000,000 |
| Wheeling | West Virginia-Ohio (Ohio River) | Suspension | 1849, 1862 | 40 | 1,010 | ..... | ..... |
| Castleton | New York (Hudson River) | Simple truss | 1924 | 135 | 1,008 | ..... | ..... |
| Cincinnati | Ohio-Kentucky (Ohio River) | Suspension | 1867, 1898 | 32.8 | 1,004 | 3,284 | 1,750,000 |
| Royal Gorge | Royal Gorge, Grand Canyon of the Arkansas River, Colorado | Suspension | 1929 | 1,053 | 880 | 1,200 | 250,000 |
| Blue Water International | Michigan-Canada (St. Clair River, Port Huron, Mich., to Water Island, Point Edward, Canada) | Cantilever | 1938 | 150 | 871 | ..... | 3,250,000 |
| Thousand Island International | New York-Canada (St. Lawrence River, Collins Landing, N. Y., to Wells Island and from Wells Island to Hill Island, Canada) | Suspension-concrete arch | 1938 | 150 | 800 | 4,740 | 3,050,000 |
| Eads | St. Louis, Mo.-East St. Louis, Ill. | Steel arch | 1874 | 55 | 520 | 6,434 | 10,000,000 |
| Lake Washington | Washington (crosses Lake Washington from Seattle to Mercer Island) | Pontoon | 1940 | ... | 200 | 8,644 | 8,850,000 |

Cobden; began a long parliamentary career as chief orator for the Free Trade movement; greatest speech was in opposition to the Crimean War, but he reached the height of his popularity as champion of the Parliamentary Reform Bill of 1867.

Bright-line spectrum S-241, picture S-242

Brighton (*brī'tŏn*), England, popular seaside resort 50 mi. s. of London; pop. 148,000; map E-270a

Brighton Beach, N. Y. C-329

Bright's disease K-16

Bright, Saint. See in Index Bridget

Brigitta, Saint. See in Index Bridget of Sweden

Brilliant pattern, in diamond-cutting D-62, picture D-60

Brilliant type T-172

Brimstone, old name for sulphur S-233

Brindisi (*brēn'dē-sē*), Italy, ancient Brundisium, chief Roman seaport on Adriatic; now commercial town of 41,000; Roman ruins; center of air lines connecting with the East; map I-156

Brine, salt solution S-15, picture S-17 freezing, use in F-194

'Bringing Home the New-born Calf', painting by Millet, picture P-22

Brink, Carol Ryrie (born 1895), author of children's books, born St. Paul, Minn.; Newbery Medal (1936) for 'Caddie Woodlawn', the story of her grandmother on the Wisconsin frontier in 1864 ('Anything Can Happen on the River'; 'Baby Island'; 'All over Town').

Briquettes, artificially made bricks of coal C-288, 284

Brisbane, Arthur (1864-1936), American newspaper editor, born Buffalo, N. Y., editor New York World, New York Evening Journal, Washington Times; noted for direct, forceful, popular style of editorials, appearing chiefly in papers owned by W. R. Hearst.

Brisbane, Australia, cap. of Queensland, on Brisbane River 25 mi. above mouth; pop. 300,000; exports wool, hides, gold: A-374, Q-8, map A-372a, b, picture A-374

Briseis (*brī-sē'is*), maid loved by Achilles A-8

Bristlecone fir, rare evergreen tree (*Abies venusta*) of pine family, native to Santa Lucia Mountains, Monterey County, Calif. Grows 30 ft. to 100 ft. high; spirelike. Leaves stiff, pointed, to 2½ in. long, dark green with 2 white bands on underside. Cones to 4 in. long, bristly appearing because of thin spines that extend beyond edges of the bracts (leaflike parts of the cone).

Bristles H-196 use in brushes B-250

Bristol, Conn., city 15 mi. s.w. of Hartford; pop. 30,167; clocks and watches, automobile bearings, scissors; famous in 18th century for wooden clocks; map C-336

Bristol, England, city 8 mi. from Bristol Channel, pop. 400,000; B-244, map E-270a

Bristol, Pa., borough on Delaware River 20 mi. n. of Philadelphia in rich farming and truck-raising region; pop. 11,895; manufactures textiles, airplanes, carpets, leather, chemicals.

Bristol, R. I., port on Narragansett Bay 13 mi. s.e. of Providence; pop. 11,159; partly destroyed during

Key—cāpe, āt, fār, fāst, whāt, fāll; mē, yēt, fērn, thēre; īce, bīt; rōw, wōn, fōr, nōt, dō; cūre, būt, rŭde, fūll, bŭrn;

- Revolutionary War; site was once home of Indian chief King Philip: map R-97
shipyards P-357
- Bristol**, Tenn.-Va., city on boundary line between two states, 110 mi. n.e. of Knoxville; pop. 23,772; manufactures leather, paper, lumber, furniture, underwear and hosiery, flour, mine cars; King College: map T-46
- Bristol Bay**, inlet of Bering Sea n. of Alaska Peninsula, map A-105
- Bristol Channel**, arm of Atlantic between s. Wales and s.w. England, maps E-279, E-270a
- Britain** (Roman Britannia), English form of ancient name of England, Scotland, and Wales, now sometimes applied to all of British Isles. For geography and later history see in *Index* Great Britain
- Arthurian legends A-315-16, W-3
- Britons E-269-70, C-124: baskets E-58. See also in *Index* Celts
- history E-269-70: Christianity introduced E-270, C-76
- literature E-283
- London, early history L-184-5, 190
- '**Britannia, the Pride of the Ocean**', British patriotic song N-24
- Britannia metal**, alloy of tin, antimony, copper, and sometimes zinc; proportions vary according to intended use; first made in Sheffield, England, in 1770; largely supplanted pewter.
- Britan'nicus** (42-55 A.D.), son of Emperor Claudius; poisoned by step-brother Nero.
- British America**, phrase usually applied to Canada and Newfoundland, but more broadly to all British territory in the Americas—Bermuda, Falkland Islands, British Honduras, British Guiana, and British West Indies.
- British Baluchistan** I-30, map I-31
- British Broadcasting Corporation** R-31
- British Columbia**, westernmost province of Canada; 366,255 sq. mi.; pop. 694,263; cap. Victoria: B-244-7, map C-50b
- agriculture B-246
- cities, list B-244: Vancouver V-271; Victoria V-294-5
- commerce and transportation V-271, V-294-5
- fisheries B-246, picture C-55
- forests B-246, pictures C-54, C-53
- history B-247
- libraries L-106n
- minerals B-246, V-271, picture C-56
- national parks N-23
- natural features B-244-6, list B-244
- products, list B-244
- Robson Glacier, picture C-50
- Vancouver V-271
- Victoria V-294-5, picture B-246
- British Columbia, University of**, at Vancouver, B. C.; opened 1915; provincial control; arts, commerce, applied science, nursing, agriculture.
- British Commonwealth of Nations** B-248. See also in *Index* British Empire
- British East Africa**, large territory in center of e. coast including Kenya Colony and Protectorate, Tanganyika Territory, Uganda Protectorate, Nyasaland Protectorate, and islands of Zanzibar and Pemba: E-138-40, maps E-139, A-42a, b
- lakes E-138, T-8, V-297
- native quarters, picture A-41
- Pemba Z-216
- people E-138, 139, pictures A-34, E-138
- Tanganyika Territory E-139, B-247
- Zanzibar Z-215-16, pictures A-41
- British East India Company** A-145, S-249
- American Colonies R-83
- India I-38-40; Clive C-271-2; Hastings H-234; Calcutta C-21
- British Empire** B-247-8, map B-248. See also in *Index* England, history of area and population B-248
- bibliography G-146
- changing status E-276, B-248, Outline G-145
- colonies, dominions, and dependencies C-308, Outline G-144-5
- commerce: foreign trade, pictograph I-110f; per capita I-110a, pictograph I-110e
- decorations of honor D-32
- Empire Day H-322
- foundations laid B-247, Outline G-145
- government B-247-8: cabinet C-3, colonies C-308
- imperialism, Outline G-145
- India, status of I-40
- woman suffrage W-133
- British Empire, Order of**, established 1917 to reward War service; conferred upon women as well as men.
- British Empire Exhibition** F-5
- British Guiana**, a crown colony on n.e. coast of South America; 90,000 sq. mi.; pop. 340,000; cap. Georgetown: G-182-3, maps G-183, S-208b
- Kaieteur Falls G-183, picture S-206b
- Venezuela boundary dispute V-276-7
- British Honduras**, a British crown colony in Central America; 8598 sq. mi.; pop. 56,000; cap. Belize: timber, especially mahogany and logwood, bananas, citrus fruits, cacao: H-330, C-133d, maps C-132, N-150c. See also in *Index* Central America
- British India**, that part of India directly subject to British law I-40, map I-31. See also in *Index* India
- British Isles**, name popularly applied to Great Britain, Channel Islands, Ireland, Isle of Man, and numerous surrounding islands; 121,633 sq. mi.; pop. 47,230,000; maps E-270a, 279, E-326d
- Channel Islands C-139
- folk-songs and folk-dances F-134, pictures F-132, 133
- geologic history E-319
- Great Britain G-144-6: England E-268-81; Scotland S-44-7; Wales W-2-3
- Hebrides H-267
- Ireland I-124-9, 130-1
- Man, Isle of M-49
- Orkney Islands O-251
- people: racial affinity, diagram R-9b
- Shetland Islands S-116
- tea consumption T-21, 27
- Wight, Isle of W-97
- British Malaya**, British possessions in Malay Peninsula and near-by islands, including Straits Settlements and Federated and Unfederated Malay States; 53,245 sq. mi.; pop. more than 5,000,000; map A-332c. See also Malay Peninsula
- British Museum** L-190, E-328-30, picture E-336, table M-392, 393
- Bible manuscripts B-104, picture B-102
- collections, pictures E-336, G-161
- royal library L-105, B-188: microfilm of books L-106
- British New Guinea**, former name of Papua N-85
- British North America Act** C-60, 63-4
- British North Borneo**, colony in n. Borneo; 31,106 sq. mi.; pop. 270,000; timber, rubber, tobacco: B-197
- British oak** O-189-90
- British Somaliland**, protectorate in n.e. Africa bordering Gulf of Aden; 68,000 sq. mi.; pop. 350,000; chief town, Berbera: maps A-42a, E-308
- British South Africa Company** R-99, S-202
- British thermal unit** H-260, 262, picture H-261
- British West Indies**, those islands of West Indies belonging to Great Britain; include Bahamas, Barbados, Jamaica, Leeward Islands, Windward Islands, and Trinidad and Tobago. See in *Index* West Indies; also names of islands and groups
- Brit'omart**, a maiden knight, representing chastity, in Spenser's 'Faerie Queene' (from Britomartis, a nymph of Crete, made goddess by Artemis).
- Brit'ons** E-269-70, C-124. See also in *Index* Celts
- Brit'tany** (French Bretagne), province of n.w. France B-248-9, map F-179
- Brest B-234
- Nantes N-3-4
- people F-172, B-248-9, picture F-171
- surface F-173
- Brittleness**, in physics, defined P-190
- Brittle stars**, a type of starfish S-277
- Brno** (*běrnō*), or Brünn, Germany; city in Moravia, 70 mi. n. of Vienna; pop. 265,000; woolen manufactures; university; history dates back to 9th century: maps C-422, G-66
- Broadax**, a tool, picture P-221d
- Broad bean** B-67
- Broadcasting** R-27, 28-31b
- advertising supports R-30
- author's rights E-191
- first R-27
- stations: guide to air pilots A-78; licensing R-26, 31
- television T-41-2
- vocational opportunities R-28
- Broadcloth**, a fine, lustrous woolen fabric; also fine, closely woven cotton or silk fabric with mercerized surface
- origin of name S-259
- Broadhorn**, a type of flatboat, picture P-221f
- Broad-leaved trees**, one of the two great tree divisions T-130, 136
- Broad River**, a stream rising in the Blue Ridge Mountains of North Carolina and flowing s.e. through South Carolina, joining with Saluda to form the Congaree; about 220 mi. long and navigable for small boats about 141 mi. above Columbia, S. C.: map N-156
- Broadsword**, a single-edged, broad-bladed sword used for cutting rather than thrusting; the claymore, a two-edged broadsword, formerly the national weapon of the Scottish Highlanders.
- Broadway**, street in New York City N-126-7, picture N-128
- number of electric signs E-238
- Broad-winged hawk** B-288
- Broddingnag** (*bröb'djng-näg*), in 'Gulliver's Travels' S-343
- "**Bro, Bro, Breda**," Danish version of game "London Bridge Is Falling Down" P-250, picture P-249
- Broca** (*brö-kä*), Paul (1824-80), French surgeon and anthropologist; founded Anthropological Institute; discovered seat of articulate speech in brain.
- Brocade**, a cloth T-63
- French 18th century, picture T-68
- Italian Renaissance T-64, picture T-67
- Japanese, picture T-63

ü=French u, German ü; gem, go; thin, then; ñ=French nasal (Jean); zh=French j (z in azure); x=German guttural ch

Brocade moth, eggs, *picture* B-285
Broccoli (*brōk'ō-lī*, Italian *brōk'kō-lē*), a vegetable of the cabbage family (*Brassica oleracea italica*); said to have been brought to Italy from Cyprus: C-1
Broche (*brōsh*), implement used in tapestry weaving T-10
Broché (*brō-shā*), term applied to fabrics woven with a raised design, as brocades.
Brock, Emma Lillian (born 1886), illustrator and author of children's books, born Port Shaw, Mont.; animals are the chief characters of her picture books ('Runaway Sardine'; 'To Market! To Market!'; 'Drusilla').
Brock, Isaac (1769-1812), British general, "hero of Upper Canada"; aided by Tecumseh, captured Detroit in the War of 1812; killed during American attack on Queenston Heights.
Brock, Sir Thomas (1847-1922), English sculptor; distinguished for power and skill in portraiture; work includes bust of Longfellow in Westminster Abbey, London, and portraits of Queen Victoria and Thomas Gainsborough.
Brocken, highest peak in Harz Mts. (3745 ft.) H-233
Brock'et, a South American deer D-37
Brockton, Mass., city 18 mi. s. of Boston, one of most important centers in world for manufacture of men's shoes; pop. 62,343: *map* M-82
Brockville, Ontario, port, railroad and manufacturing city on St. Lawrence River 60 mi. s. of Ottawa; pop. 9736; dairy and lumber products, hardware, copper wire, cables, hats.
Brockway, Howard (born 1870), composer, born Brooklyn, N. Y.; orchestral works ('Sylvan Suite'); compiled folk-songs of Kentucky mountains.
Brod (*brōt*), Max (born 1884), German writer of novels, short stories, and dramas, born in Prague of Jewish parents; worked at Prague as government official and as journalist ('Redemption of Tycho Brahe'; 'Reuben').
Brüggerite (*brū'gēr-it*), a radioactive mineral M-183
Brogie (*brō'yū*), Louis César Victor Maurice, Duc de (born 1875), French scientist, born Paris; won Nobel prize in physics (1929) for notable work on mechanics of wave lengths, electricity, optics, X-rays wave theory of electronics A-362, R-16
Broiling, in cookery C-349
Broken Hill, Australia, mining town in w. of New South Wales; pop. 27,000: *map* A-372a
Broker B-160, S-292
Brokerage S-292
Bromberg (*brōm'bérk*). *See in Index* Bydgoszcz
Bromegrass, a genus (*Bromus*) of annual and perennial grasses; native to temperate regions of the world. Smooth brome (*B. inermis*) used as hay and pasture grass. Some species are pests and dangerous to live stock when the long clusters of barbed fruits mature.
Bromelia, a small genus of perennial plants of tropical America, of the pineapple family; has dense clusters of reddish flowers succeeded by plum-shaped fruit; spiny leaves; used for hedges in the tropics; fruit juice used for a beverage; also called pinguin and wild pine.

Bromelia family, pineapple family, or Bromeliaceae (*brō-mē-li-ā'sē-ē*), a family of plants or shrubs, native chiefly to warm regions, including the bromelia, pinguin, pineapple, and Spanish-moss.
Bromfield, Louis (born 1896), American novelist, born Mansfield, Ohio; won Pulitzer prize, 1926; in 'The Green Bay Tree', 'Possession', 'Early Autumn', and 'A Good Woman' presents straightforward, objective picture of contemporary American life and revolt against it; in 'The Strange Case of Miss Annie Spragg' enters into mysteries of character; in 'The Rains Came' shows life in a native Indian state.
Bromide, a compound of bromine with a metal or a radical C-176
 silver, in photography P-182-3
Bro'mine, a chemical element C-176, *table* C-168
 Dead Sea product P-34
 photographic use P-183
 poisonous properties P-275
 seaweed yields B-109
 specific gravity of vapor P-190
Bronchi (*brōn'ki*) (singular *bronchus*), the two main branches of the windpipe, or trachea L-219
Bronchial tubes L-219
Broncho bean. *See in Index* Jumping bean
Bronco, or broncho, a small half-wild horse of western North America: H-344, *picture* A-52
 "bronco busting" C-113
Bron'stein, Leon, real name of Leon Trotsky T-144
Brontë (*brōn'tā*), Anne (1820-49), English author, youngest sister of Charlotte Brontë; pen name, Acton Bell ('The Tenant of Wildfell Hall').
Brontë, Charlotte (1816-55) (pseudonym Currer Bell), English novelist, one of a strange family of geniuses ('Jane Eyre', novel that brought her fame and still the most popular of her works; 'Shirley', portrait of Emily Brontë; 'Villette', considered by many her masterpiece; 'The Professor').
Brontë, Emily (1818-48) (pseudonym Ellis Bell), sister of Charlotte Brontë, considered by many greatest genius of the family ('Wuthering Heights', crude and powerful romance).
Bron'tosaur, prehistoric reptile A-204, 206, *picture* A-205
 skeleton found in Utah N-22
Bronx, a borough of New York City; pop. 1,394,711: N-131, 134, *map* N-130
Bronx Park, N. Y., zoölogical garden Z-224
Bronze, alloy of copper and tin B-249, A-131-2
 Ghiberti's doors G-84, I-168, *picture* G-85
 Japanese work J-200, 202
 lamps: Greek and Roman L-56, *picture* L-57; prehistoric L-56
 metal working M-123, 124-5; Chinese C-221h-i; Greek work, *pictures* M-123; Japanese, *picture* M-124
 paint P-32
 statuary S-65
Bronze Age, prehistoric period B-249, *picture* C-245
 Chinese ritual vessels C-221h-i
 Iron Age follows I-134-5, E-210
 pottery, *picture* M-47
Bronze turkey T-158
Bronzino (*brōnd-zē'nō*), Angelo (1503-72) Italian artist of late Florentine

school; a mannerist with elegant parlor style ('Christ in Limbo'; 'Martyrdom of St. Lawrence').
Brook, Alexander (born 1898), painter, born Brooklyn, N. Y.; figure, landscape, genre painter; identified with modernists ('Georgia Jungle'; 'My Son Sandy'; 'Katherine Hepburn').
Brooke, Dorothea, heroine of George Eliot's 'Middlemarch'.
Brooke, Frances (1724-89), Canadian novelist C-65
Brooke, Henry (1703-83), Irish author of children's books L-159
Brooke, Leonard Leslie (1862-1940), English artist, born Birkenhead; illustrated 'Nursery Rhyme Book' by Andrew Lang; his picture books for children built chiefly on nursery rhymes and classics; well known in America for his Johnny Crow books from 'Ring o' Roses', *picture* L-110
Brooke, Rupert (1887-1915), English poet of great promise; died of blood-poisoning in first World War; wrote exultantly, sensitively, and vividly of life, love, beauty, and warfare ('Poems'; '1914 and Other Poems'; 'Letters from America').
Brooke, Sir Alan Francis (born 1883), British army officer, expert in technical warfare and army mechanization; directed retreat from Dunkirk, 1940; made chief of the British Imperial General Staff December, 1941.
Brooke, Stopford A. (1832-1916), English clergyman, writer; critical and interpretative studies of Tennyson. Browning; 'History of Early English Literature'.
Brooke family, family of English rajahs of Sarawak, Borneo: Sir James (1803-68), first white rajah, ruled 1841-68, suppressed piracy and head hunting and introduced civilization; Sir Charles Johnson (1829-1917), nephew of Sir James, ruled 1868-1917; Sir Charles Vyner (born 1874), son of Sir Charles, rajah since 1917: B-197
Brook Farm, communistic experiment founded 1841 at West Roxbury, Mass., by Transcendentalists; George Ripley leader, Hawthorne, Margaret Fuller, Channing, Emerson, Thoreau members or sympathizers; dissolved 1847; gave Hawthorne idea for 'Blithedale Romance'.
Brookfield, Ill., suburb of Chicago, noted especially for zoölogical gardens; pop. 10,817
 Chicago Zoölogical Park Z-224-5, 222
Brookhart, Smith W. (born 1869), U. S. senator from Iowa, born Missouri; country school teacher; lawyer; U. S. senator 1922-25, 1926-33; Progressive Republican, actively interested in problems of the farmer; special adviser to Agricultural Adjustment Administration 1933-35.
Brookings, S. D., city 55 mi. n. of Sioux Falls; pop. 5346; trade center for prosperous farming region; South Dakota College of Agriculture and Mechanic Arts: *map* S-218
Brookings Institution, Washington, D. C., an amalgamation of the Institute of Economics, Institute for Government Research, and the Robert Brookings Graduate School of Economics and Government, for research and research training in social sciences; formed 1927.
Brookline, Mass., residential suburb of Boston; first settled in 1634; pop. 49,786: B-202

- Harvard Medical School, *picture* M-81
- Brooklyn, N. Y., a borough of New York City on Long Island; pop. 2,698,285; B-249, N-124, *map* N-130 piers, *picture* H-216
- Brooklyn, Polytechnic Institute of, at Brooklyn, N. Y.; founded 1853; chemical, mechanical, civil, and electrical engineering.
- Brooklyn Bridge B-240, *pictures* N-129, A-312, *table* B-342
- Brooklyn College, Brooklyn, N. Y., established 1930 by combining Brooklyn branches of College of the City of New York and Hunter College, established 1926; municipally controlled; arts and sciences, education, graduate school.
- Brooklyn Navy Yard, in elbow of East River; purchased by Federal government in 1801; repairs and builds all types of naval vessels, conducts naval research: B-249, *map* N-130
- Brooks, Charles S. (1878-1934), American author, born Cleveland, Ohio; retired from printing business 1915 to write; organized Little Theater in Cleveland; writings whimsical, witty ('Journeys to Bagdad'; 'Frightful Plays'; 'Luca Sarto')
- Brooks, Joseph (1821-77), Arkansas politician known for governorship conflict with Baxter A-299
- Brooks, Phillips (1835-93), American preacher, born Boston, Mass.; internationally famous orator, Episcopalian bishop of Mass.; wrote hymn, 'O Little Town of Bethlehem'
- Brooks, Preston Smith (1819-57), American congressman from South Carolina (1852-56)
- assaults Charles Sumner S-326
- Brooks, Van Wyck (born 1886), American literary critic, born Plainfield, N. J.; literary editor, *The Freeman*, 1920-24; shows keen understanding in analyzing and interpreting recent tendencies in literature ('Letters and Leadership'; 'The Ordeal of Mark Twain'; 'Emerson and Others'; 'Flowering of New England', awarded Pulitzer prize 1937; 'New England: Indian Summer')
- Brooks, Walter Rollin (born 1886), writer, born Rome, N.Y.; highly diverting nonsense stories for children ('To and Again'; 'Freddy the Detective'; 'Clockwork Twin'; 'Wiggins for President')
- Brooks Field, U. S. Army Air Corps flying school 7 mi. s.e. of San Antonio, Tex.
- Brooks Range, Alaska, mountains extending across northern part of Alaskan peninsula, *map* A-105
- Brooks's, club in London, founded 1764 as Almack's Club; Sir Joshua Reynolds, Sheridan, Burke, C. J. Fox, Horace Walpole noted guests.
- Brook trout T-145, F-75
- Brookwood, England, location of American military cemetery U-226
- Broom, Jacob (1808-64), American statesman, born Baltimore, Md.; member House of Representatives from Pennsylvania; nominated by Native American Party in 1852 for president of United States.
- Broom B-250
- Broom, shrub of the pea family emblem of the Plantagenets H-275
- Broomcorn, a variety of sorghum B-250
- Broomcorn millet, or proso millet M-176
- Brotherhood of St. Andrew, an organization of men and boys in the Episcopal Church, the object of which is "to aid in the extension of Christ's kingdom"; senior and junior departments; founded 1883 in Chicago; now international.
- "Brother Jonathan," nickname for U. S. N-143
- 'Brothers Karamazof' (*kä-rä-mäz'öf*), The', a lengthy novel (1880) by Feodor Dostoyevsky relating the tragedy of three brothers in a provincial Russian town.
- Brothers of the Christian Schools, an order of monks M-236
- Brougham (*brə'ām*), Henry, Baron (1778-1868), British lord chancellor and Liberal reforming statesman; made reputation as counsel for Queen Caroline in defense against divorce from George IV; his unique private carriage was forerunner of the brougham.
- Brown (*brəʊn*), Heywood (1888-1939), American writer, born Brooklyn, N. Y.; educated at Harvard; was successively newspaper reporter, sports writer, dramatic critic, literary editor, and columnist; identified with labor and social reform movements; wrote novels 'The Boy Grew Older', 'The Sun Field', and 'Gandle Follows His Nose'; breezy and outspoken humorist.
- Brouwer, or Brauer (*brə'ēr*), Adrian (1606?-38), Flemish genre and landscape painter; peasants, tavern scenes favorite subjects; expert technician, colorist ('Sleeping Peasant'; 'Quarrelling Gamesters').
- Browallia (*brō-wāl'i-ā*), annual plants of the nightshade family, native to South America. The small tubular flowers of blue, violet, or white grow in loose, elongated clusters; leaves smooth and oval.
- Browder, Earl (born 1891), American Communist party leader, born Wichita, Kan.; joined Socialist party at age of 15; represented Red International of Labor Unions in China 1927-29; general secretary of Communist party in the U. S. 1930-41; convicted by New York Federal Court, January 1940, of using false passport and sentenced to 4 years in prison, fined \$2,000; sentence commuted, May 1942.
- Brown, Abbie Farwell (1875?-1927), American writer, born Boston; best known for imaginative children's stories ('In the Days of Giants'; 'The Lonesome Doll'); also wrote poems ('A Pocketful of Posies').
- Brown, Alice (born 1857), American writer of novels, short stories, poems, and dramas, born Hampton Falls, N. H.; known especially for analysis of New England characters ('Tiverton Tales'; 'Dear Old Templeton'; 'Children of Earth', drama).
- Brown, Sir Arthur Whitten (born 1886), English aviator; with Sir John Alcock first to cross Atlantic in airplane, *picture* A-73, *table* A-74
- Brown, Charles Brockden (1771-1810), American novelist, born Philadelphia; first American professional man of letters ('Wieland' and other tales of terror).
- Brown, Edna Adelaide (born 1875), American author and librarian, born Providence, R. I.; librarian, Memorial Hall Library, Andover, Mass., since 1906; noted for her wholesome outdoor, adventure, and home life stories ('Four Gordons'; 'When Max Came'; 'Robin Hollow'; 'Chinese Kitten').
- Brown, Ford Madox (1821-93), English painter; realistic treatment of historical subjects painting by, *picture* C-159
- Pre-Raphaelites influenced by P-23 Rossetti and R-158
- Brown, George (1818-80), Canadian statesman, born in Scotland; one of earliest advocates of Confederation and one of first to foresee the development of Canadian Northwest; founded the *Toronto Globe*.
- Brown, Henry Kirke (1814-86), American sculptor, noted for his statues of public men S-62
- Brown, Jacob (1775-1828), American soldier; prominent in War of 1812; born Bucks County, Pa.; rose to rank of major general; distinguished himself at Fort Erie, Chippewa, and Lundy's Lane; became general in chief of U. S. Army (1821).
- Brown, John (1800-59), American abolitionist B-250, *picture* C-250
- Kansas border warfare K-7, B-250
- Brown, John (1810-82), Scottish physician and author; 'Rab and His Friends' and 'Marjorie Fleming' extremely popular for their kindly, humorous characterization.
- Brown, Paul (born 1893), artist and author of children's books, born Mapleton, Minn.; his specialty is drawings of horses in action expressed with humor ('Crazy Quilt'; 'Piper's Pony'; 'War Paint').
- Brown, Peter, carpenter on *Mayflower*; ancestor of John Brown, the abolitionist.
- Brown, Prentiss Marsh (born 1889), public official, born St. Ignace, Mich; U. S. congressman 1933-37, senator 1937-43; head of Office of Price Administration January to October 1943.
- Brown, Robert (1773-1858), Scottish botanist, born Montrose, Scotland; 1801-05 naturalist in expedition headed by Matthew Flinders for survey of Australian coasts; discovered Brownian movement and also the distinction between gymnosperms and angiosperms.
- Brown, Walter Folger (born 1869), U. S. postmaster general under President Hoover; born Massillon, Ohio; assistant secretary of commerce 1927-29.
- Brown, any of several colors consisting of strongly neutralized reds or red-yellows
- mixture of red and green pigment C-308f-h
- Brown ash. *See in Index* Black ash
- Brown bear B-69, *picture* B-69
- Brown Bess, type of musket F-48, *picture* F-49
- Brown coal, or German lignite C-284
- Brown creeper, a bird, *color plate* B-139
- Browne, Charles Farrar. *See in Index* Ward, Artemus
- Browne, Lewis (born 1897), writer, born in England, came to America in 1912; rabbi of Temple Israel, Waterbury, Conn. (1920-23) and of Free Synagogue, Newark, N. J. (1924-26); resigned to write; has illustrated some of his own work ('Stranger than Fiction', a history of the Jews; 'This Believing World', an account of religions; 'That Man Heine'; 'All Things Are Possible').
- Browne, Maurice (born 1881), Anglo-American dramatist and play producer; born England; director Chicago Little Theatre; produced 'Journey's End' puppetry P-368c

ü=French u, German ü; gem, go; thin, then; ñ=French nasal (Jean); zh=French j (z in azure); k=German guttural ch

- Browne, Sir Thomas** (1605-82), English physician and author; unrivaled master of stately, rhythmic, but artificial and Latinized prose ('Religio Medici'; 'The Garden of Cyrus'; 'Urn Burial').
- Browne, Thomas Alexander.** See in *Index* Boldrewood, Rolf
- Browne, William** (1591-1643), English poet ('The Shepherd's Pipe').
- Brown hyena** H-369
- Brownian movement**, rapid haphazard movement of fine particles in solution, visible in microscope; caused by collision with molecules of solution; discovered by R. Brown of England in 1827
- ultramicroscope** reveals M-158
- Brownie**, in Scottish folklore, a good-natured goblin F-3, S-303f
- "Brownies,"** sister organization to Girl Scouts G-93-4
- Browning, Elizabeth Barrett** (1806-61), English poet, wife of Robert Browning B-250, 251
- child labor** attacked by C-205
- Browning, John M.** (1854-1926), American inventor of firearms M-6
- Browning, Robert** (1812-89), English poet B-251-2, E-287, picture E-287
- Browning machine gun** M-6-8, pictures M-9
- Brown Library, John Carter, Providence, R. I.** P-358
- Brown race** R-10, *Outline* R-12, picture R-11. See also in *Index* Malays; Polynesians
- numbers P-304d
- Brown rat** R-51
- Brown rice** R-103
- Brownson, Orestes A.** (1803-76), American political and religious writer, born Stockbridge, Vt.; was in turn a Universalist minister, advocate of Socialistic theories, Unitarian organizer of a church of his own (1836), and finally (1844) a convert to Roman Catholicism; published *Boston (Brownson's) Quarterly Review*.
- Brownson Deep**, in Atlantic Ocean A-358, map A-359
- Brown sugar** S-320, 322
- Brownsville, Tex.**, city and port at mouth of Rio Grande; important gateway for trade between Mexico and U. S.; citrus fruit and truck farming; hats, clothing, cottonseed oil, brick, tile; pop. 22,083; scene of numerous clashes with Mexicans: T-56; map T-56
- Brown Swiss cattle**, or Schwyz cattle, dairy breed C-104
- Brown-tail moth**, a whitish moth (*Euproctis chrysorrhoea*), with brown-tipped abdomen; accidentally introduced into U. S. from Europe; larvae cause great damage to shade trees in New England
- control by parasites** I-90
- elm** damaged by E-256
- related to gipsy moth** B-286
- Brown thrasher** T-85
- Brown thrush**, name sometimes given to brown thrasher T-85
- Brown trout**, of Europe T-145
- Brown University**, at Providence, R. I.; for men, separate college (Pembroke) for women; founded 1764, present name 1804 in honor of Nicholas Brown, a benefactor; non-sectarian; arts, science, engineering, education, graduate school: P-358
- Brownwood, Tex.**, city 120 mi. s.w. of Fort Worth; pop. 13,398; flour, cotton, and cottonseed oil, petroleum and gasoline, brick and tile, clothing; Daniel Baker and Howard Payne colleges.
- Bruce, Sir David** (1855-1932), British army physician and bacteriologist, born Melbourne, Australia; made lieutenant colonel 1900; did research in Malta fever and African sleeping sickness.
- Bruce, H(enry) Addington** (born 1874), American writer, born Toronto, Canada; contributor to newspapers and magazines and lecturer on psychological and sociological subjects; has done much to popularize psychology and psychological research ('The Riddle of Personality'; 'Woman in the Making of America'; 'Psychology and Parenthood').
- Bruce, James** (1730-94), Scottish explorer, rediscoverer of source of Blue Nile and first white man to follow it from its source to junction with White Nile.
- Bruce, Robert** (1274-1329), king of Scotland, victor at Bannockburn B-252
- Bruce, Stanley Melbourne** (born 1883), Australian statesman, born in Melbourne; educated at Cambridge; practised law in London; became merchant in Melbourne; took active part in first World War; elected to Australian parliament 1918; treasurer of Commonwealth 1921-23; prime minister 1923-29.
- Bruce, William Speirs** (1867-1921), Scottish explorer of Arctic and Antarctic; led Scottish National Antarctic expedition 1902-04, discovering 150 miles of Antarctic coast line.
- Bruch (brʊk)**, Max (1838-1920), German violinist and composer (operas, 'Lorelei' and 'Hermione'; for violin, 'Kol Nidrei' and four concertos; cantatas, probably his greatest works, 'Fritzhof', 'Salamis', 'Odysseus', 'Achilleus').
- Brucine (brʊˈsɪn)**, a poisonous alkaloid drug (C₂₂H₂₆N₂O₄) S-308
- Bruckner (brʊkˈnɛr)**, Anton (1824-96), Austrian organist and composer; practically self-taught virtuoso; used principles of Wagner's dramatic opera in writing his symphonies.
- Bruckner, Eduard** (born 1862), Austrian geographer and geologist; advanced climate cycle theory in 1890 and collaborated with Albrecht Penck on 'The Alps During the Ice Age': C-271
- Brueghel**, family of painters. See in *Index* Breughel
- Bruening (brʊˈniŋ)**, Heinrich (born 1885), German clergyman, statesman and financial expert; captain in first World War; entered Reichstag as member of Centrist Party, becoming leader of that group; chancellor 1930-32 with practically dictatorial powers; put through financial program which saved Germany from economic crisis in 1931; opposed Hitler for president and later became voluntary exile from Germany; appointed to teaching staff of Harvard University 1937.
- Bruges (brʊʃ)** (Flemish Brugge, German Brügge), Belgium, old Flemish town 55 mi. n.w. of Brussels; pop. 52,000: B-252-4, B-87, map B-87, picture B-88
- book trade**, medieval B-180
- Bruin the Bear**, character in beast epic of 'Reynard the Fox' F-166
- Bruises**, treatment for F-66
- Brulé, Etienne** (died 1633), Canadian explorer, born Champigny, France; in 1608 emigrated to Canada and became an Indian interpreter; 1615 accompanied Champlain to the Huron country; explored through Pennsylvania to Chesapeake Bay; the first white man to reach Lake Superior (1622); murdered by Hurons.
- Brulé (brʊˈlə)**, a tribe of the Teton Sioux Indians living chiefly in North Dakota.
- Brummell, George Bryan** (1778-1840), "Beau Brummell," English dandy, dictator of fashion, early friend of Prince of Wales (King George IV).
- Brundisium, Italy.** See in *Index* Brindisi
- Bruneau (brʊˈnɔ)**, Alfred (1857-1934), French composer; influenced by his friend Zola, introduced into theater lyrics of realistic nature; some of his librettos based on Zola's novels ('L'Attaque du moulin').
- Brunei (brʊˈnɔ)**, chief town of Brunei, Borneo; built on piles over Brunei River; pop. 12,000: maps A-332c, E-142
- Brunei**, sultanate in British Borneo B-197
- Brunei, Sir Marc Isambard** (1769-1849), British inventor and engineer, born in France; perfected many inventions, including block pulleys for rigging of ships, wood-working machinery, machine for making seamless shoes, etc., but most famous for invention of a shield system of boring (after watching a shipworm at work), which he used in constructing Thames tunnel
- portland cement** tested C-125
- Brunelleschi (brʊˈnɛlˌɛsˈkɛ)**, Filippo (1379?-1446), Italian architect, called founder of Renaissance architecture
- dome of Florence cathedral** I-168, picture F-108
- Donatello** and I-167-8
- Ghiberti** and G-84
- Brunetière (brʊˈniɛrˌtɛˈjɛr)**, Ferdinand (1849-1906), French critic, editor of the *Revue des Deux Mondes* ('Histoire de la littérature française classique') quoted F-195
- Brunhild (brʊnˈhɪl)** (German Brünhilde), in Scandinavian mythology 'Nibelungenlied' N-140
- opera** O-233, M-314
- Brunhilde, Queen**, also Brunhilda (died 613), wife of Siebert I of Eastern Frankland and daughter of Athanagild, king of Visigoths; accomplished, beautiful, and an able ruler. When her sister Galwintha, wife of Chilperic, king of West Frankland, was murdered, Brunhilde waged war against Chilperic's kingdom. She was finally captured, tortured, and dragged to death by wild horses.
- Brunhoff, Jean de** (1899-1937), French artist; author and illustrator of children's books ('The Story of Barbar').
- Brünn (brʊn)**, Germany. See in *Index* Brno
- Bruno (brʊˈnɔ)**, Saint (1030?-1101), German monk; festival Oct. 6; founded Carthusian Order in 1086.
- Bruno, Giordano** (1548?-1600), Italian Renaissance philosopher; began career as Dominican friar, but was

Key—cāpe, āt, fār, fāst, whāt, fāll; mē, yēt, fērn, thēre; īce, bīt; rōw, wōn, fōr, nōt, dā; cūre, būt, rȳde, fȳll, bȳrn;

- expelled for heresy; his views brought him into conflict also with Calvinists and Lutherans; expanded teaching of Copernicus into a form of pantheism and attacked the Christian doctrine of immortality; burned at the stake in Rome Feb. 17, 1600.
- Brunswick, Ga.**, seaport and popular resort in s.e. on St. Simons Sound, 4 mi. from Atlantic; pop. 15,035; fishing and canning interests, naval stores, lumber: *map* G-56
- Fort Frederica Monument N-22**
- Brunswick, state in w. Germany**, duchy until 1918; 1418 sq. mi.; pop. 510,000. Also its cap., an old city 35 mi. s.e. of Hanover; pop. 147,000; extensive manufactures; 12th-century cathedral: *map* G-66
- first savings bank B-40**
- Brunswick, Me.**, town 25 mi. n.e. of Portland; pop. 7003; rayon, cotton goods, newsprint, paper boxes; Bowdoin College: *map* M-38
- Brunswick, House of.** *See in Index* Hanover, House of
- Brusa (brg'sä)**, Turkey. *See in Index* Bursa
- Brush, Charles Francis (1849-1929)**, American inventor, born Euclid, Ohio; pioneer investigator of electric lighting; invented a storage battery and many other electrical engineering devices
- arc light developed by E-233**
- Brush, Christine Chaplin (1842-92)**, American writer, born Bangor, Me. ('Colonel's Opera Cloak', story of southern family in north; 'Inside Our Gate', story of own family).
- Brush, George de Forest (1855-1941)**, American painter, born Shelbyville, Tenn.; works are decorative and have fine pictorial quality; many "mother and child" groups, Indian subjects, portraits.
- Brush, of electric generator and motor E-216, picture E-217**
- Brushes B-250**
- paint P-32b**
- Brush turkey, a bird of the group Megapodes**, native to Australia and New Guinea; named from its habit of living in brushwood
- method of hatching eggs E-192**
- Brush wolf, prairie wolf, or coyote W-128, picture W-129**
- Brusilov (brg-sël'öf)**, Alexei (1856-1926), Russian general; brilliant successes in Galicia 1914-15 and 1916; after revolution of 1917 was in supreme command for short time, later accepting Bolshevik régime: W-160
- Brussels (brüs'ëlz)**, or Bruxelles (brü-sël'), cap. of Belgium; pop. (with suburbs) 835,000: B-254, B-87-8, *map* B-87
- Royal Museum of Fine Arts, table M-392**
- Brussels, University of B-254**
- Brussels carpet R-174, picture R-172**
- Brussels lace L-48**
- Brussels sprouts, vegetable of cabbage type C-1, picture C-1**
- scientific name C-3**
- when and how to plant G-13**
- 'Brut'. See in Index** Layamon
- Brutus, Lucius Junius**, legendary Roman patriot; one of first two consuls of the Republic (509 B.C.): R-129-30
- Brutus, Marcus Junius (85? 42 B.C.)**, Roman republican, one of Caesar's assassins although aided and promoted by him; fled Rome and seized Macedonia; committed suicide
- when defeated at Philippi; hero of Shakespeare's 'Julius Caesar': C-13**
- Brutus the Trojan**, mythical first king of Britain, grandson of Ascanius, the son of Aeneas.
- Bruxelles (brü-sël')**, Belgium. *See in Index* Brussels
- Bruyère (brü-yër')**, Jean de la (1645-96), French essayist and wit; one of best writers of classical French ('Caractères'; 'Mémoires').
- Bryaceae (brî-ä'së-ë)**, a large family of mosses M-272
- Bryan, Charles Wayland (born 1867)**, American politician, born Salem, Ill.; brother of William Jennings Bryan; Democratic candidate for vice-president of U.S. in 1924; governor of Nebraska 1923-25, 1931-35.
- Bryan, John Neely**, American pioneer; in 1841 built log hut on Trinity River and became first white settler of Dallas, Tex.: D-6
- Bryan, William Jennings (1860-1925)**, American political leader and editor B-254-5
- campaigns' against McKinley M-14, 16**
- Bryan, Tex.**, residential city 85 mi. n.e. of Austin; pop. 11,842; fruit, livestock, and dairy market; large plantations in surrounding area.
- Bryant, Sara Cone (born 1873)**, American author, born Melrose, Mass.; lecturer on story-telling ('Stories to Tell to Children', 'Gordon in the Great Woods', 'Story Reader').
- Bryant, William Cullen (1794-1878)**, "father of American poets" B-255, A-177, *picture* A-177
- Bryce, George (1844-1931)**, Canadian historian and Presbyterian clergyman; organizer of Manitoba College (1871); authority on Canadian Northwest ('Remarkable History of Hudson's Bay Company'; 'A Short History of the Canadian People').
- Bryce, James, Viscount (1838-1922)**, British statesman and historian, ambassador to U. S. ('The Holy Roman Empire'; 'The American Commonwealth', a classic; 'Modern Democracies'; 'A Study of American History').
- Bryce Canyon National Park, Utah N-20, picture N-19**
- Bryn Mawr (brîn mâr)** College, at Bryn Mawr, Pa.; for women; opened 1885 (founded 1880); arts and sciences: *picture* C-302
- Bryology**, the branch of botany that deals with mosses. *See in Index* Moss
- Bryophyta (bryophytes)**, a phylum of the plant kingdom P-244, *Outline* B-205
- Bryozoa (brî-ö-zö'd)**, or moss animals W-180b
- Brythonic languages**, a group comprising Welsh, Cornish, and Breton, belonging to Celtic branch of Indo-European family; so called from word "Brython," which means a Briton of southern stock
- Irish related to I-132**
- Bryum**, genus of mosses, *picture* M-271
- Brzesc-Litewski (bër-zhës'ts' lë-tëf'skë)**, Poland. *See in Index* Brest-Litovsk
- Bubble-nest builders**, group of fish A-234
- Bubbles, soap S-178**
- iridescence explained L-129**
- Newton studying, picture N-111**
- Bubble sextant A-78**
- Bubble tower**, for petroleum refining P-150
- Bu'bi**, group of Bantu-speaking black tribes inhabiting island of Fernando Po, w. of Africa; still in Stone Age at time of discovery.
- Bubonic plague, or Black Death**, epidemic disease, causing swollen glands, fever, and rapid death B-153
- carried by rat flea B-153, picture F-106**
- effect on English agriculture A-59**
- germ isolated G-78, picture G-78**
- Hundred Years' War interrupted by H-358**
- Bucaramanga (bq-kä-rä-män'gü)**, Colombia, town in n. on Lebrija River; pop. 82,000; coffee, tobacco, cotton, gold, iron, silver: *map* C-305
- Bucare (bq'kä-rä)**, a tree. *See in Index* Erythrina
- Buccaneers**, piratical adventurers (chiefly English and French) who in 17th century plundered Spaniards along coasts of W. Indies and S. America: C-306. *See also in Index* Pirates and piracy
- Bucephalus (bü-sëf'ä-lüs)**, favorite horse of Alexander the Great; city of Bucephala, on Hydaspes (now Jhelum) River in India, built by Alexander in his memory.
- Buchan (bük'an)**, John (first Baron Tweedsmuir) (1875-1940), British writer and statesman; appointed governor general of Canada 1935; wrote 'History of the Great War', 'The People's King'; popular romantic novels ('Greenmantle'; 'The Three Hostages'; 'Witch Wood'; 'Montrose'; 'A Prince of the Captivity'; 'Pilgrim's Way', autobiography)
- quoted on Scott's 'Old Mortality' S-50**
- Buchanan (bü-kän'an)**, James (1791-1868), 15th president of the U. S. B-255-7
- administration (1857-61) B-256-7**
- Dred Scott decision D-103**
- first Atlantic cable laid C-8**
- Fort Sumter agreement F-161**
- his hostess in White House W-91**
- John Brown's raid B-250**
- Lincoln-Douglas debates L-145**
- secession B-256**
- Ostend Manifesto C-250-1**
- Bucharest (bü-kä-rës't')**, or Bucuresti, cap. of Rumania, 30 mi. n. of Danube River; pop. 650,000: B-257, *maps* B-18, E-326c, *picture* R-175
- Bucharest, Treaty of, ended 2d Balkan War (1913) B-20**
- Rumania gains in territory R-174**
- Saloniki given to Greece S-15**
- Bucharest, University of**, state university of Rumania, founded 1864; law, medicine, science, philosophy, theology, mathematics: B-257
- Buchmanism**, an international movement for "moral rearmament" through "God-control," started in 1921 by Frank N. D. Buchman, American Lutheran minister (born 1878). Its members cooperate for mutual spiritual encouragement through informal associations called "Oxford Groups."
- Buck, Dudley (1839-1909)**, American organist, composer, and author, born Hartford, Conn.; sacred songs, anthems, cantatas, operas ('Golden Legend').
- Buck, Frank (born 1884)**, American writer, motion picture producer, collector of wild animals, born Gainesville, Tex.; began collecting jungle animals, birds, reptiles for U.S. zoos in 1911; expeditions to South America, Malaya, India,

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- Borneo, New Guinea, Africa; motion pictures (also books written with E. Anthony) 'Bring 'Em Back Alive', 'Wild Cargo'.
- Buck, Pearl Sydenstricker** (born 1892), American writer, born Hillsboro, W. Va.; spent childhood in China where her father and mother were missionaries; in 1932 received Pulitzer prize for her novel 'The Good Earth'; received Nobel prize in literature 1938 ('Sons'; 'The Mother'; 'The Patriot'): A-181, picture A-183
- Buckeye, or horse-chestnut** B-257-8 growth of buds, pictures N-35 leaves, pictures L-88, 89 "red" type poisons fish P-274
- Buckeye butterfly, color plate** N-38a-b
- Buckeye State**, popular name for Ohio.
- Buckingham, George Villiers, first Duke of (1592-1628)**, British courtier, unscrupulous favorite of James I and Charles I (called "Steenie" by James); involved England in war with France Charles I and C-147
- Buckingham, Henry Stafford, 2d Duke of (1454?-83)**, leader of uprising against Richard III R-105
- Buckingham, William A. (1804-75)**, governor of Connecticut C-341
- Buckingham Memorial Fountain**, Chicago, picture H-367
- Buckingham Palace**, London L-188-9
- Buckinghamshire, or Bucks**, s. midland county, England; 743 sq. mi.; pop. 272,000; great dairying center.
- Buckley, James Monroe (1836-1920)**, American minister and author, born Rahway, N. J.; in Methodist Episcopal ministry, 1858-80; editor New York *Christian Advocate* 1880-1912 ('Christians and the Theatre').
- Bucknell University**, at Lewisburg, Pa.; arts and sciences, school of music; incorporated 1846.
- Buckner, Simon Bolivar (1823-1914)**, Confederate general and politician; governor of Kentucky (1887-91) surrenders to Grant G-132
- Buckner, Simon Bolivar, Jr. (born 1886)**, U. S. Army officer, son of above, born near Munfordville, Ky.; graduated West Point 1908; spent much of army career as infantryman and specialist in tanks; made commander Alaska Defense Force July 1940.
- Buckram**, a coarse linen or cotton cloth, used as stiffening in velvet and cloth hats and also in book-binding.
- Bucks**. See in Index Buckinghamshire
- Buckskin**, a leather L-85 tanning L-84
- Bucktails**, name given to members of Tammany Hall from about 1817-26; derived from custom of members wearing a buck's tail in their hats.
- Buckthorn, or ironwood**, common name for trees or shrubs of the genus *Bumelia* of the sapodilla family; native to s. United States and tropics Borneo production B-197
- Buckthorn family, or Rhamnaceae (rām-nā'sē-ē)**, a family of plants, vines, shrubs, and trees, including the jujube, buckthorn, Japanese raisin-tree, coffee-berry, cascara, and New-Jersey-tea.
- Buckwheat** B-258, picture N-118 introduced into Europe C-406
- Buckwheat family (Polygonaceae)**, a large family of herbs; includes buckwheat, rhubarb, dock, mountain sorrel, and smartweed.
- Bucolles (bū-kōl'iks)** (from Greek word for "cowherd"), pastoral poems of Greek and Roman poets, particularly Vergil.
- Bucovina, or Bukovina (bū-kō-vē'nā)**, province of Rumania, former land of Austria; 4030 sq. mi.; chief city Cernauti; cattle-raising and farming: map B-18 Rumania acquires R-174 Russia acquires part R-175, R-194b
- Bucuresti (bū-kū-rēsht')**, Rumania. See in Index Bucharest
- Bucyrus (bū-sī'rūs)**, Ohio, city on Sandusky River 65 mi. s.e. of Toledo; pop. 9727; road construction machinery, garden hose, clay products; railroad shops; near numerous mineral springs.
- Bud**, undeveloped shoot, forming stem, flowers, or leaves flower F-121, picture F-122 leaf: protection T-149; unfolding, pictures N-35, H-290
- Bu'da, Hungary**, now part of Budapest B-258
- Budapest (bū'dā-pēst or bū'dā-pēsht')**, cap. of Hungary; pop. over 1,000,000: B-258, map A-381
- Budapest Agricultural Museum**, table M-393
- Buddha (būd'ā)** (about 568-488 B.C.), founder of Buddhism B-258-9
- Botree**, sacred to T-136: cutting from, Ceylon C-137
- living Buddhas** M-222d
- sacred mountain in Ceylon** C-137
- statues: Canton, picture** C-78; Daitusu J-200, picture J-202; Tibet, picture A-329
- stories about** S-303a-b
- Bud'dhism, an oriental religion** B-259
- Burma** B-279, picture B-259
- ceremony: burning joss sticks before Buddha, picture** C-221e
- Ceylon C-137, B-259**
- China C-221e**
- Hinduism and H-293**
- holy lands A-332**
- Japan J-190: teachings represented by monkeys, picture** M-231
- Lamaism: in Mongolia M-222d; in Tibet T-90**
- number of adherents** B-259, I-35
- Thailand T-73b**
- Buddhist architecture**
- Angkor Vat A-332, I-73d, pictures** A-331, I-73, F-4
- Canton temples, picture** C-78
- Japan J-196, picture** J-201
- Pagoda in Rangoon B-278, picture** B-278a
- Pagoda of Soochow, China, picture** A-275
- Temple of Boro Budor, Java J-205, picture** J-204
- Vat Arun, Bangkok, Thailand, pictures** T-73b, A-275
- Budding, or gemmation**, a mode of asexual reproduction in low forms of plants and animals in which an outgrowth on the parent results in the formation of a new individual cells, picture C-121
- hydra H-366, picture** H-365
- jelly-fish J-210**
- liverworts L-166**
- sponges S-262**
- yeast Y-204**
- Buddleia, or Buddleja (būd-lē'ā)**, a genus of shrubs and trees of the logania family; evergreen in tropics. Flower spikes of tubular, lilac, white or yellow florets; leaves narrow; also called butterfly-bush.
- Budějovice (būd-yā-yō-vět'sē)**, Bohemia. See in Index České
- Budenny (bū'dēn-i)**, Semyon Mikhailovich (born 1883), Russian general; cavalry leader in Bolshevik campaigns 1917-20; made 1st vice-
- commissar of defense August 1940; commander on the Ukraine front in 1941.
- Budgell, Eustace (1686-1737)**, English writer; associated with Steele and Addison in writing for the *Tatler* and the *Spectator*.
- Budget**, an estimate of the amount of money to be spent in a given time, together with a plan showing the purposes for which the money will be spent. Term was originally applied to the black bag containing his statement of accounts carried by the British chancellor of the exchequer, later to the contents of the bag; hence its present usage
- household H-326, T-87: buying a home** B-265
- reform in England L-173-4**
- Budget, Bureau of the, U. S. U-232**
- Buell, Don Carlos (1818-98)**, American soldier prominent in Civil War on Federal side; became major general of volunteers; long controversy followed his campaign in Tennessee and Kentucky in which he was replaced by Gen. Rosecrans.
- Buenaventura (būā-nā-vēn-tō'rā)**, Colombia, important Pacific port at mouth of Dagua River; pop. 31,000; coffee, hides, gold, platinum: C-306, map C-305
- Buena Vista (by'nā vis'tā)**, Spanish *būā'nā vis'tā*, battle of, in Mexican War M-132
- Buenos Aires (bō'nōs ā'rēs)**, Spanish *būā'nōs ā'rās*, cap. of Argentina, harbor on Rio de la Plata, 165 mi. from sea; pop. 2,325,000: B-259-61, A-278, 280b, d, maps A-279, S-208c, picture A-280b
- capitol, pictures** A-280b, c
- harbor, pictures** H-217, A-280c
- museum, table** M-392
- Buff, Conrad (born 1886)**, artist, born Switzerland; moved to California in 1905; well known for mural paintings and lithographs of the West; illustrator of children's books, chiefly those written by his wife, Mary Marsh Buff (born 1890) ('Dancing Cloud', a Navaho Indian boy; 'Kobi', a boy in Switzerland).
- Buffalo, N. Y.**, at e. end of Lake Erie, 2d largest city of state; pop. 575,901: B-261-2, map N-114, pictures H-216, N-121
- Cleveland mayor** C-266
- Buffalo B-261**
- Cape buffalo B-261, picture** A-33
- carabao, or water buffalo** B-261, C-102, P-168, R-175, pictures B-261, C-221b, P-165
- tsetse fly** A-203
- Buffalo, American, or American Bison, B-148-51. See also Bison**
- Buffalo, University of, at Buffalo, N. Y.**; founded 1846; arts and sciences, education, library science, pre-engineering, medicine, law, dentistry, pharmacy.
- Buffalo Bayou, Texas** H-346
- "Buffalo Bill" (William Frederick Cody) (1846-1917)**, noted American frontiersman and Indian fighter B-262, picture S-219
- European tour** H-231
- Wild West show** B-262, C-238, F-13
- Buffalo bird** B-261
- Buffalo bug, or buffalo moth** B-84
- Buffalo bur**, a low growing annual plant (*Solanum rostratum*) of nightshade family, found in cent. North America. Grows 1 ft. to 2 ft. high; leaves and stems covered by white hairs; leaves lobed. Flowers yellow, 1 in. wide, 5 petals; fruit prickly. Sometimes called sandbur and bur-grass: P-236

Key—cāpe, āt, fār, fāst, whāt, fāll; mē, yēt, fērn, thēre; īce, bīt; rōw, wōn, fōr, nōt, dō; cāre, būt, rīde, fūll, būrn;

Buffalo dance, of Mandan Indians, picture I-66

Buffalo fish, name for several large fishes of sucker family (*Catostomidae*), found throughout Mississippi River valley. The common, or big-mouthed, buffalo (*Megastomatobus cyprinella*) and the small-mouthed buffalo (*Ictiobus bubalus*) are important food fishes.

Buffalo Gap, S. D., pop. 182 S-218

Buffalo gnat, an insect closely related to the northern black fly; torments horses and cattle eggs E-192

Buffalo moth, a beetle B-84

Buffalo National Park, Alberta, Canada A-111, N-22f, map C-50b

Buffer state, small independent state lying between two larger ones, thus either reducing the possibility of hostilities between them or bearing the brunt of their opposing armies.

Buffet, a piece of furniture I-99

Buffon (*bü-fôn'*), Georges Louis Leclerc, Comte de (1707-88), French philosophic naturalist and writer ('Natural History') Z-227

Bug, a kind of insect. See Bugs

Bug, a telegraph transmitter, picture T-33

Bugaief (*bq-jü'yéf*), Boris Nikolaevich. See in Index Byely, Andrey

"Bug Bible" B-105

Bugle, a wind instrument B-262, picture M-322

Boy Scout playing, picture B-213

Bug River, two rivers of Europe; one, also called Western Don, rises in Poland, flows n. 470 mi. into Vistula at Novo Georgievsk; map P-278; the other in s.w. Ukraine, flows about 450 mi. to Black Sea: maps P-278, B-154

Bugs, insects with sucking beaks I-87. See also in Index Hemiptera; and names of individual bugs aphids, or plant lice A-226 beetles not true "bugs" B-85 chinch C-222

cicada C-235

cochineal C-291

control S-262-3, G-11, C-222

lac insect L-52

nymph stage I-86

scale insects S-34-5

scientific name I-88

water-bugs W-46-7

Buhl furniture F-222

Building B-263-8. See also in Index Architecture; Heating and ventilating; Housing; Shelter. For list of terms commonly used in building, see in Index Architecture, table

acoustics S-196

air conditioning H-266

air spaces in brick walls B-238

chimneys S-113, S-304

closets, planning B-266

columns, steel B-264

concrete construction, picture B-267:

flooring B-266; houses B-265

cornice, picture A-259

doors, planning B-266

drainage system in houses B-266, P-260

earthquake-proof construction E-136, T-104, J-197

elevators E-250-1

federal aid B-265, R-146f

fireproofing F-59, B-264, B-265-6:

asbestos A-323

floors: houses A-172, B-266-7, M-262; skyscrapers B-264

foundations B-264, 266: under water D-72, P-265

frame, beginnings S-111, 112, 113

gas engines used G-19

hobby. bibliography H-313k

hoist B-263, picture G-19

homes B-265-8. See also in Index

Housing; Shelter

industries, Outline I-77

lighting L-56-9, B-268

lightning protection L-135

model housing projects S-114

oldest stone masonry building E-203

planning H-325, B-265-8

plumbing P-260

regulations: cement construction

C-127; set-back style, picture

A-272; zoning C-241-2

roofs: development A-261-2; houses

B-266; skyscrapers, fireproof

B-264; types A-269, 271, picture

A-168

skeleton construction A-273, B-263,

pictures A-265, B-264, 265

skyscraper A-273, B-263-4

Chicago C-191, 193, pictures C-187,

193

lightning protection L-135

New York City N-125, pictures

N-123, 125, 128-9, 132, B-263

set-back design C-242, pictures

A-272, N-125

sound control S-196

standardized forms B-263; house

units B-268

termites, protection against T-52a

truss A-273

vocation V-329

windows B-266, A-268-9, 271: an-

cient and modern L-59; height

in kitchen B-267; space required

L-59

zoning C-241-2, picture A-272

Building and loan association B-262

Building materials B-263-8. See also

in Index Building; Shelter; and

chief topics listed below

adobe, or sun-dried clay B-236,

S-113, pictures S-112, N-95, A-253

alloys A-131

aluminum B-266

ancient and medieval S-110-13:

brick B-236, A-257-8, pictures

A-253, A-258, 260, C-211

asbestos A-323

bamboo B-36, pictures P-166, C-307

bark, reeds, and grasses S-110-11

brick B-236-9

cement C-124-8, C-328

chalk, picture M-183

clay C-259-61

concrete C-328, C-124-8, B-264, 265-

6, picture B-267

copper C-358

coquina, native Florida stone S-6

fire-resisting B-264, 265-6, A-323

glass, structural G-104

granite G-131, M-184

gypsum G-190

insulating: asbestos A-323; diatoma-

ceous earth O-200; glass wool

G-105; gypsum G-190; terra cotta

B-264

iron work, ornamental M-124, pic-

ture M-125

limestone L-138

lumber L-212-9, U-194

marble M-60-1

metals B-266, 268, M-125, pictures

M-125, V-321

modern S-113-14

paper, use in Japan S-113, J-197-8

plywood P-264

roofing A-337, B-264, C-358

sandstone S-23

slate S-158

steel B-263-5, A-273, I-146

stone Q-1-3; limestone L-138; sand-

stone S-23; slate S-158

stucco B-265, picture C-125

terra cotta B-264, pictures B-265,

267

tile B-239, B-264, picture B-267;

mosaics M-262

wire, reinforcing W-121

wood L-212-19, U-194

Buisson (*bwē-sôn'*), Ferdinand (1841-

1932), French statesman and edu-

cator; member Chamber of Deputies; professor at Sorbonne; winner Nobel peace prize (1927).

Buitenzorg (*boi'tēn-zōrk*), city in Java; pop. 65,000: J-205

Bukhara. See in Index Bokhara

Bukken Fiord, arm of Atlantic in s.w. Norway; 10 to 15 mi. wide, extending 35 mi. inland; just s. of Hardanger Fiord.

Bukovina. See in Index Bucovina

Bulawayo (*bq-lā-wū'yō*), municipality in Southern Rhodesia, South Africa; cap. of Matabeleland; white pop. about 29,000; Cecil Rhodes buried near here: map E-139

Bulbs, tubers, and rootstocks B-269

bloodroot B-158-9

crocus C-399

hyacinth H-364-5

iris I-130

lily L-136-7

mandrake M-53

onion O-225

potato P-324-6

sweet potato S-341

tulip T-149

Bul'bul, a Persian nightingale N-144

scientific name N-145

Bul'finch, Charles (1763-1844), American architect, born Boston; designed Beacon Hill monument, Boston, and built many public and private buildings in New England; appointed architect of capitol at Washington, 1818, and designed west approaches and portico; his sincere simple style greatly influenced American architecture.

Bullfinch, Thomas (1796-1867), author, born Boston, Mass.; best known for his 'Age of Fable', still published under the title of 'Bulfinch's Mythology'; other works 'Age of Chivalry', 'Legends of Charlemagne'.

Bulgaria, Balkan state; about 42,800 sq. mi.; pop. 6,400,000; cap. Sofia: B-269-71, maps B-18, E-326e, f, Outline B-21

cities B-271, list B-269: Sofia S-190

commerce: imports and exports,

table C-480

education B-269

flag F-94, color plate F-88

history B-270-1

Russo-Turkish War (1877-78) and

Bulgarian autonomy T-163-4,

B-270

independence declared T-164, B-270

Balkan wars (1912-13) B-20

1st World War: declaration W-157;

military events W-160, 164;

armistice W-164; peace settle-

ment W-174, B-271

Macedonian question M-5

2d World War: regains territory

and coöperates with Germany

B-271

people B-269, B-17: racial affinity,

diagram R-9b

products B-269-70, list B-269: attar

of roses P-124

Bulger, Andrew (1789-1858), Cana-

dian soldier and governor of Assin-

iboia (1822); born Newfoundland.

Bulkhead, of ships S-127

Bull, Ephraim Wales (1806-95),

American horticulturist, born Bos-

ton

produced Concord grape G-135

Bull, Ole (1810-80), a celebrated

Norwegian violinist and composer,

largely self-taught; developed mar-

velous technique

'The Saeter-Maiden's Sunday' N-174

Bull, the male of domestic cattle and

numerous other animals, especially

elk, moose, elephant, whale, seal

preventing attack by, picture S-2j

Bull, in speculation B-161
Bull, papal P-56
Bull, or **Taurus**, a constellation of the zodiac Z-218, *charts* S-275, 275f, *h* Aldebaran in S-275b, *charts* S-275f, *h* Pleiades in P-259, *charts* S-275f, *h*
Bull, Golden, originally any charter with golden seal or bulla; especially, edict issued 1356 by Emperor Charles IV: G-72
Bullard, Robert Lee (born 1861), army officer, born Youngshoro, Ala.; colonel in Spanish-American War; in 1st World War commanded 1st Division and 3d Army Corps.
Bull-bat, or nighthawk N-144
Bullboat B-166
Bulldog D-79, 82, *picture* D-77
Bulldozer, a wide steel blade mounted at a right angle to front of a tractor; can be raised or lowered; used for leveling and moving earth, pushing rocks, uprooting trees.
Bul'len, Frank T. (1857-1915), English writer of sea stories ('The Cruise of the Cachalot'; 'Sea Wrack'; 'The Call of the Deep').
Bullet F-50, 52
 antimony used A-222
 arsenic used A-310
 lead L-76
 shrapnel A-321, *picture* A-320
 streamlining, *picture* A-81
Bullet-proof glass G-104
Bullet-proof vest A-304
Bullet tree. See in *Index* Balata
Bull fighting S-229, *picture* S-230 in Portugal P-313
Bullfinch, a sweet-singing European bird (*Pyrrhula pyrrhula*) of finch family, named from its short, rounded bill, which suggests the head of a bull; male bluish gray and black above, bright red beneath; can be taught to whistle tunes.
Bullfrog F-209
Bullhead, or horned pout, a catfish C-100, F-74
Bullion (*bul'yón*), uncoined gold and silver in bars or ingots M-196
Bullionist theory C-322
Bullion State, popular name for Missouri.
Bullitt, William Christian (born 1891), diplomat, born Philadelphia; special assistant to Secretary of State, 1933; ambassador to U. S. S. R., 1933-36; ambassador to France, 1936-40; made special assistant to Secretary of Navy, 1942.
Bull Moose party, or Progressive party F-293, T-3
 Theodore Roosevelt leads R-152
Bullock, William A. (1813-67), inventor, born Greenville, N. Y. P-348
Bullock's oriole O-251, *color plate* B-137
Bull Run, battles of, *map* C-253
 first battle B-271
 second battle C-254
Bull-snake S-172
 food S-171
Bull terrier D-82, *picture* D-79
Bull-whackers, drivers of oxen teams in the early pioneer days; from bull-whack, a short-handled whip with a long lash.
Bull worship C-102
Büllov (*bü'löv*), Bernhard, Prince von (1849-1929), German statesman and diplomat, imperial chancellor (1900-09); had served as ambassador to Italy (1893-97) and again as special ambassador in attempt to keep Italy in Triple Alliance; it was charged that his foreign policies helped to bring about World War of 1914-18; wrote 'Imperial Germany', a defense of his policies.

Büllov, Friedrich Wilhelm, Baron (1755-1816), Prussian general, conspicuous in 1813 at battle of Leipzig; overran Holland and Belgium; aided Wellington at Waterloo.
Bulrush, any of several large rushlike or grasslike plants especially the genus *Scirpus* of the sedge family, name sometimes given also to the cat-tail; the bulrush of the Bible was a species of papyrus.
Bulwer, Sir Henry. See in *Index* Dalling and Bulwer
Bulwer-Lytton. See in *Index* Lytton
Bumble, fat, self-important beadle who is a tyrant over workhouse inmates in Dickens' 'Oliver Twist'.
Bumblebee, or humblebee B-73, 76-7, *color plates* W-32a-b, B-76a
 pollinates red clover C-281
Bump'po, Natty, frontiersman in Cooper's 'Leatherstocking Tales'; nicknames include 'Deerslayer,' 'Hawkeye,' 'The Pathfinder,' 'Leatherstocking': C-354
Buna (*bq'ná*), New Guinea, village on n.e. coast; Japanese established bases here and at Gona (15 mi. n.w.) in July 1942; recaptured by Allies: W-178y, *map* E-142a
Buna rubbers R-169a, *diagram* R-169b
Buncombe, county in N. C.; word 'bunk' originated in 1820 when Congressman Felix Walker made a lengthy speech on the Missouri Compromise, explaining that his district expected it, and he was 'speaking for Buncombe.'
Bund (*bünd*), in oriental countries, quay or water's-edge promenade Shanghai, *pictures* H-217, S-101
Bund, German-American, an organization of German-Americans, formed in 1936 in the United States, which became dominated by Nazis; sought to inspire anti-Semitism and the adoption of pro-Nazi policies: N-12n
Bundesrat (*bqn'des-rät*), the senate of the former German Empire, appointed by and representing the federated states, exercising administrative and judicial as well as legislative powers.
Bungalow, a one-storied house; name and house originated in India.
Bunin (*bq'nín*), Ivan Alexeyevich (born 1870), Russian novelist and poet; Nobel prize in literature 1933 ('The Gentleman from San Francisco'; 'The Well of Days').
Bunker Hill, battle of B-271-2
 flag F-99, *color plate* F-90
Bunker Hill Day, June 17 H-321
Bunker Hill Monument B-272, B-202, *picture* B-201
Bunner, H. C. (1855-96), American writer of short stories, novels, light verse; editor of *Puck* ('The Midge'; 'Zadok Pine'; 'Short Sixes').
Bunsen (*bün'sén*, German *bun'zén*), Robert Wilhelm Eberhard (1811-99), German chemist B-272
 burner B-272-3
 geyser, action explained by G-82
 spectroscopic studies S-241, B-272
Bunsen burner, a gas burner developed by Robert Bunsen B-272-3
Bunsen photometer, *picture* L-125
Bunt, in baseball B-56b
Bunting, bird of finch family B-273
 indigo B-273, F-35, *picture* F-35
 show B-273, *picture* B-131
Bunting, colored cotton cloth of plain weave similar to cheesecloth, used for flags and decorations; also a material made of worsted yarn, similar to nun's veiling but narrower and coarser.

Bun'yan, John (1628-88), English Puritan leader and author of 'Pilgrim's Progress' B-274-6
 place in English literature E-285, N-181
Bunyan, or **Bunyon**, Paul, hero of lumber camp tales B-276
 place in American folk-lore F-135-6
 versions of the legend S-303k-l, *p*
Buonarroti (*bwó-nür-róté*). See in *Index* Michelangelo
Buondelmonti (*bwón-dél-món'té*), Florentine family F-107
Buoy (*bq'i* or *boi*), a navigation aid L-134
 acetylene-lighted A-7
Buoyancy, ability to float; applied to supporting medium or the thing floated
 Archimedes' principle A-255, G-142-3, P-193, *picture* W-45
 balloons B-22, A-62
 ships P-193, *picture* W-45
Buran (*bq-rän'*), a Siberian blizzard S-136, W-113
Burbage, or **Burbadge** (*búr'bij*), James (died 1597), English actor and theater manager; one of owners of Blackfriars Theater: S-95, 96
Burbage, or **Burbadge**, Richard (1567?-1619), English actor of time of Shakespeare S-95
Burbank, Luther (1849-1926), American experimenter in plant breeding B-276-7
 berries R-51
 birthday celebrated H-320
Burbank, Calif., city 10 mi. n.e. of Los Angeles; pop. 34,337; fruit-growing, canning, and motion-picture industries; airplanes, motors, pottery.
Burbot, fresh-water fish (*Lota maculosa*), also called ling or lawyer; only member of cod family found exclusively in fresh water.
Bur'chell's zebra Z-216
Burchfield, Charles E. (born 1893), artist, born Ashtabula Harbor, Ohio; especially famous for modernist paintings of 'the American scene'—street scenes, freight cars, drab houses, fields.
Bur clover C-282
Burdekin River, Queensland, Australia, rises on e. slope of Great Dividing Range and flows 350 mi. into Pacific in lat. 19° 45' S.
Burden, Henry (1791-1871), American inventor, born Scotland; patented first cultivator used in U. S.: *picture* I-115
Burdett-Countts (*búr-dét' kóts*), Angela Georgina, Baroness (1814-1906), English philanthropist. greatest heiress of her time.
Burdette (*búr-dét'*), Robert J. (1844-1914), American humorist, minister, and writer, born Greensboro, Pa.
Burdiga'la, ancient name of Bordeaux B-194
Burdock, a coarse biennial (*Arctium lappa*) of the family *Compositae*, with large heart-shaped leaves and purple or pale violet flowers surrounded by stiff pointed bracts with hooked tips
 seed pods W-64, *picture* S-74
Bureau (*bü'rö*), in U. S. government. See in *Index* Census, Bureau of; Standards, Bureau of, etc.
Bureaucracy (*bü-rök'rä-si*), a system of government the control of which is largely in the hands of officials organized into bureaus or departments. The power of such officials (bureaucrats) usually lies in the fact that they are empowered to

Key—cápe, át, fär, fást, whät, fqll; mé, yét, fêrn, thére; íce, bír: rów. wón, fôr, nôt, dq; cüre, búr, ryde, fqll, bárn;

- interpret the laws and to issue regulations for law enforcement. The liberties of the citizens and the interests of the state as a whole tend to be ignored in favor of the policies and ambitions of the bureaucrats.
- Burette** (*bū-rēt'*), a chemical measuring tube.
- Bureya** (*bū-rā'yū*), river in s.e. Siberia, flowing into the Amur R. above Khabarovsk; navigable for about 200 mi. above mouth.
- Burgas** (*bqr'gūs*), port of Bulgaria, on Black Sea; pop. 36,000; called Pyrgos in Middle Ages; flour and sugar mills, soap factories: map B-154
- Burgenland**, industrial district in Ostmark on w. border of Hungary; 1532 sq. mi.; fertile soil; awarded to Austria by Treaty of Trianon, 1920; steps to occupy region in 1921 resisted by Hungary; dispute ended in 1922 by agreement to give Austria all but town of Sopron and its environs; Burgenland annexed by Germany in 1938.
- Bürgermeister** (*bür'gēr-mī-stēr*). See in *Index* **Burgomaster**
- Burgess** (*būr'gēs*), Gelett (born 1866), American humorist, born Boston ('Goops and How to Be Them'; 'Are You a Bromide?') quoted C-347b
- Burgess, John William** (1844-1931), American educator and writer, born Giles County, Tenn.; authority on political science, history, and constitutional law; professor at Columbia University 1876-1912.
- Burgess, Thornton W.** (born 1874), American author, born Sandwich, Mass.; as boy spent great deal of time outdoors observing nature; well known for children's "bed-time stories" ('The Adventures of Reddy Fox', etc.); also wrote books on flowers, birds, animals.
- Burgesses**, House of, the first American representative legislative body, called in Virginia in 1619; name continued until time of Revolution Patrick Henry in H-279-80
- 'Burghers of Calais'**, by Rodin R-126, picture R-125
- Burghley, William Cecil, Baron.** See in *Index* **Burleigh**
- Burglar alarm** photoelectric P-178 telephonic microphones B-43
- Burglar-proof safe**, material used A-130
- Bur'gomaster**, or **Bürgermeister** (*bür'gēr-mī-stēr*), title of chief magistrate in a German or Dutch town, corresponding to the English and American title of mayor.
- Burgos** (*bqr'gōs*), Spain, former cap. of old Castile on Arlanzon River, 130 mi. n. of Madrid; pop. 40,000; cap. of Franco government during Spanish civil war (1936-39): S-226, map S-226
- Burgoyne** (*būr'goin'*), John (1722-92), English general in American Revolution; after defeat at Saratoga returned to England where he devoted himself to writing plays ('The Maid of the Oaks'; 'The Heiress'); buried in Westminster Abbey American campaign R-90; Saratoga S-28 surrender celebrated H-321
- Bur-grass.** See in *Index* **Buffalo bur**
- Burgundians**, Germanic tribe E-322-3
- Burgundy** (*būr'gün-dī*), former kingdom and duchy in e. cent. France, now included in four departments; famous for its wine: map F-179
- Charles the Bold C-152-3 costume, 15th century, picture D-108 struggle with Orleanists C-150 wine F-174
- Burgundy pitch** T-12
- Burial and funeral customs** American Indian I-65-6: Mound Builders A-147, picture A-149 China, picture C-221 Egypt, ancient E-202, T-61, picture E-206: pyramid tombs E-203-4; treasures from Tutankhamon's tomb A-249-50, E-209, pictures E-199, 200
- Hindu I-37: ghats, picture B-95 legend of Alaric's burial A-99 Northmen N-166 Parsee B-171
- Buriat-Mongol** (*bqr-yāt' mōn'gōl*) Republic, an autonomous republic of Russian Soviet Federative Socialist Republic in Asia n. of Mongolia; 145,000 sq. mi.; pop. 545,000: S-138 school, picture S-137 Ulan Ude, picture S-138
- Buriats**, branch of Mongols M-224
- Bu'rin**, an engraving tool E-294
- Burke, Edmund** (1729-97), British statesman, orator, and writer B-278 American colonies, policy B-278 literary associations G-115 quoted B-278, U-234
- Burke, Martha Jane Canary.** See in *Index* "Calamity Jane"
- Burke, Thomas** (born 1887), English short-story writer, novelist, poet, and journalist; orphaned when very young, rose from office boy; skilful interpreter of East London life ('Limehouse Nights'; 'London Lamps'; 'The Wind and the Rain').
- Burke's Peerage**, name commonly given to the publication 'Genealogical and Heraldic Dictionary of the Peerage and Baronetage of the United Kingdom', compiled 1826 by John Burke, and published annually since 1847; contains names of all British peers and baronets.
- Burl**, knotlike growths of various sizes found on trunks of redwood, Carpathian elm, walnut, thuya, and other trees; often used for veneers redwood S-80
- Burlap**, a coarse, plain-woven fabric made of jute, manila, hemp, or flax; used for bags, upholstery, draperies, wall covering jute J-232
- Burleigh, Henry Thacker** (born 1866), American Negro barytone and composer, born Erie, Pa.; revived Negro spirituals.
- Burleigh** (*būr'li*), or **Burghley**, William Cecil, Baron (1520-98), English statesman, for 40 years chief adviser of Queen Elizabeth.
- Burleson, Edward** (1798-1851), American pioneer and soldier, born North Carolina; settled on frontier of Texas 1830; prominent in struggle of Texas against Mexico and in Mexican War; vice-president of Republic of Texas, 1841-44.
- Burlesque** (*būr-lēs'k'*), a comical, ludicrous or grotesque representation, especially in imitation of some more serious work in literature or the drama (from Italian *burla*, mockery). See also in *Index* **Satire** ancient Greek drama D-92-3
- Burley tobacco** T-103
- Burlingame, Anson** (1820-70), congressman and diplomat; made minister to China by Lincoln 1861; negotiated Burlingame Treaty.
- Burlingame**, Calif., residential city 15 mi. s. of San Francisco; minor industries; pop. 15,940.
- Burlingame Treaty** (1868), first recognition by China of principles of international law; free migration granted between China and U. S.
- Burlington, Iowa**, city in s.e. on Mississippi River; pop. 25,832; engines, furniture; sand and limestone quarries; railroad shops: map I-120
- Burlington, N. C.**, industrial town 50 mi. n.w. of Raleigh; pop. 12,198; hosiery and other mills; tobacco warehouses: map N-156
- Burlington, N. J.**, port of entry on Delaware River 18 mi. n.e. of Philadelphia; pop. 10,905; iron products, silk, shoes: map N-90
- Burlington, Vt.**, port on Lake Champlain; pop. 27,686; Trinity College, University of Vermont and State Agricultural College; burial place of Col. Ethan Allen: V-287, map N-86 state university, picture V-285
- Burma** (*būr'mā*), British possession, in n.w. Indo-China, on e. side of Bay of Bengal; 260,000 sq. mi.; pop. 14,655,000; cap. Rangoon: B-278-9, I-73a, maps I-30, 31, A-332c, Outline I-44
- Bingyi caves**, picture B-259
- cities B-279** climate B-278, 278a exports and imports B-278b government B-279, I-40 history B-279: Japanese invasion W-178z natural features B-278a people B-278a, 279: citizenship in U.S. denied N-27 products B-278a-b lac L-52 minerals B-278b: jade G-28, B-278b; petroleum B-278b, picture P-145; rubies G-29, picture G-28; sapphires G-29; tungsten T-150 rice growing R-103, B-278a, b shelter B-279 transportation B-278b-c women B-279
- Burma road**, major supply route to China during war with Japan; 715 mi. long: B-278b
- Burne-Jones, Sir Edward** (1833-98), English Pre-Raphaelite painter, noted for highly decorative design: P-23, pictures P-23, B-180 stained glass B-201 William Morris and M-261
- Burner** Bunsen B-272-3 for lamps: Argand invents L-57; gas lighting G-22, 23; oil lamps L-56-7
- Burnet, David G.** (1788?-1870), Texan patriot, born Newark, N. J.; first president Texas republic (March-September 1836).
- Bur'net, Gilbert** (1643-1715), British bishop and historian ('History of My Own Time').
- Burnett** (*būr-nēt'*), Frances Hodgson (1849-1924), American novelist, born in England; wrote for both children and adults; stories are colorful and romantic ('Little Lord Fauntleroy'; 'The Secret Garden'; 'Head of the House of Coombe').
- Burnett, Peter H.** (1807-95), American pioneer and lawyer, born Nashville, Tenn.; emigrated to Oregon 1843; led party to California 1848, and founded Pacific Bank in San Francisco ('Recollections and Opinions of an Old Pioneer').
- Burney, Fanny** (1752-1840), also known by her married name Mme. d'Arblay, English novelist; first novel, 'Evelina' (1778), made her one of the most famous writers of the day; her 'Diary and Letters' contains much interesting matter

ü=French u, German ü; gem, gō; thin, then; ñ=French nasal (Jean); zh=French j (z in azure); κ=German guttural ch

- about Dr. Johnson and other literary figures.
- Burnham, Clara Louise** (1854-1927), American author, born Newton, Mass.; daughter of George F. Root, the composer; many of her novels treat of New England, also show the influence of her faith in Christian Science ('Dr. Latimer'; 'The Right Princess'; 'Jewel'; 'The Opened Shutters').
- Burnham, Daniel Hudson** (1846-1912), American architect and city planner, born Henderson, N. Y.; planned Chicago's World's Fair of 1893: C-190, C-241
- Burnham, Sherburne W.** (1838-1921), American astronomer, born Thetford, Vt.; professor of astronomy, University of Chicago; made important discoveries in double stars.
- Burning** F-45-6. *See also in Index* Combustion
- Burning-bush.** *See in Index* Spindle tree
- Burning glass**, a convex lens L-96, H-262, *pictures* L-97, H-262
- Burnley**, England, city in Lancashire 22 mi. n. of Manchester; pop. 98,000; cotton and worsted weaving, iron manufactures.
- Burns, John** (born 1858), first labor member English House of Commons 1892-1918; president local government board 1905-14, of board of trade 1914; opposed England's entrance into World War of 1914-18 and retired to private life.
- Burns, Robert** (1759-96), Scotland's greatest poet B-279-80, E-286
- Burns, Tommy** (Noah Brusso) (born 1881), Canadian boxer, born Hanover, Ontario; world's heavyweight champion, 1906-8.
- Burns, William J.** (1861-1932), American detective, born Baltimore; employed in many U. S. government cases; chief U. S. secret service 1921.
- Burns and scalds**
prevention F-56-58, S-2d
treatment F-66
- Burnside, Ambrose Everett** (1824-81), American Civil War general, born Liberty, Ind.; commanded McClellan's left wing at Antietam; succeeded McClellan in command of Army of Potomac, Nov. 7, 1862; removed after defeat at Fredericksburg, but served as subordinate until end of war: F-193
- Burnt alum** A-137
- Bur oak** O-189, 190
- Burpee, Lawrence Johnston** (born 1873), Canadian historian and author; gives excellent accounts of early Canadian explorers ('Search for the Western Sea'; 'Discovery of Canada'; 'Dictionary of Canadian History').
- Burr, Aaron** (1756-1836), 3d vice-president of the United States B-280-1
conspiracy B-281
duel with Hamilton H-205, B-281
election V-293
- Burr, Theodosia** (1783-1813), daughter of Aaron Burr B-281
- Burr**, of plants
chestnut, *pictures* C-184, 185
weeds W-64
- Burrhel** (*bûr'el*), or blue sheep, a wild sheep S-105
- Burritt, Elihu** (1811-79), American philanthropist and reformer, born New Britain, Conn.; being both linguist and blacksmith, earned title of "Learned Blacksmith"; organized, 1846, League of Universal Brotherhood for Abolition of War; attended various peace congresses ('Sparks from the Anvil'; 'Walks in the Black Country').
- Burro** (*bûr'ô*), a small donkey used especially as a pack animal. *See in Index* Ass
- Burroughs, Bryson** (1869-1934), American painter, born Hyde Park, Mass.; excelled at decorative landscape and fantastic interpretation of legends; curator of paintings, Metropolitan Museum of Art, New York City, after 1907.
- Burroughs, Edgar Rice** (born 1875), American writer of fanciful adventure stories, born Chicago ('Tarzan of the Apes').
- Burroughs, John** (1837-1921), American naturalist and writer B-281 quoted W-84b, E-123
- Burroughs, William S.** (1857-98), American inventor, born Rochester, N. Y.
calculating machine C-20
- Burroughs Newsboys Foundation**, Harry E., Boston, Mass.; established 1928 by Harry E. Burroughs, Russian-American lawyer and former newsboy, to raise the cultural level of the newsboy.
- Burrow**
badger, *picture* H-289
chipmunk C-222
earthworm E-137
gopher G-121
mole M-216-7
prairie-dog P-342
rabbit, *picture* H-223
- Burrowing owl** O-257
- Bursa**, or Brusa, historic city of Turkey, 15 mi. s. of Sea of Marmara; pop. 72,000; hot sulphur and iron springs; silk and carpet manufactures: *maps* B-154, A-332b
- Burslem** (*bûr's'lem*), England, famous pottery town in Staffordshire; pop. 42,000; birthplace of Josiah Wedgwood
Wedgwood potteries P-332
- Burt, (Maxwell) Struthers** (born 1882), American novelist, born Baltimore; newspaper reporter and instructor in English at Princeton; after 1908 lived chiefly on ranch in Wyoming; novels deal with contemporary life ('The Interpreter's House'; 'The Delectable Mountains'; 'Festival'). 'The Diary of a Dude Wrangler' is an account of his own ranch life. His wife, Katharine Newlin Burt (born 1882), is also a novelist.
- Burt, William A.** (1792-1858), American inventor and surveyor, born Petersham, Mass.; self-educated inventor of "solar compass," surveyor's instrument still in use; government surveyor in Michigan and discoverer of iron ore in Marquette County; active in politics.
- Burton, Sir Richard Francis** (1821-90), English explorer and writer; translator of 'Arabian Nights'; discovered Lake Tanganyika: A-244
- Burton, Robert** (1577-1640), English author; 'The Anatomy of Melancholy', curious, fantastic book, beloved by Lamb and Samuel Johnson
place in literature E-285
- Burton, Theodore Elijah** (1851-1929), American legislator, born Jefferson, Ohio; served in both houses of Congress 30 years; important work in waterways development; president American Peace Society 1911-15 and 1925-29.
- Burton-on-Trent**, England, county borough in Staffordshire and Derbyshire; pop. 50,000; seat of enormous brewing industry: *map* E-270a
- Buru**, Dutch Boeroe (*bû'rô*), island of Molucca group, Netherlands Indies, w. of Ceram; about 3400 sq. mi.; pop. 17,000; exports sago, timber, cajuput oil: *map* E-142a
- Bury, John Bagnell** (1861-1927), Irish historian, regius professor of modern history in Cambridge University; edited Gibbon's 'Decline and Fall of the Roman Empire'; author of histories of Greece and Rome.
- Bury**, England, town in Lancashire 10 mi. n.w. of Manchester; pop. 57,000; cotton and woolen manufactures, foundries.
- Buryat-Mongol Republic.** *See in Index* Buriat-Mongol
- Bury St. Edmunds**, or St. Edmundsbury, England, town in W. Suffolk 60 mi. n.e. of London; pop. 17,000; named from Saxon King Edmund; ruins of old Benedictine abbey.
- Bus.** *See in Index* Motor-bus
- Busby, Richard** (1606-95), English schoolmaster, head of Westminster School; notorious for use of the birch; teacher of Dryden and Locke.
- Bush.** *See in Index* Shrubs
- Bush**, remote, thinly settled interior of a country which has not been cleared for cultivation
Australia A-374
South Africa S-199
- Bushel**, a unit of measure W-66, *tables* W-69, 67, 68
- Bushmaster**, large, poisonous snake of the pit-viper family, *Crotalinae*; habitat, Central America and tropical South America.
- Bushmen**, people of South Africa A-39, S-200, *pictures* S-203, E-344
racial affinity, *diagram* R-9b
Stone Age E-346
- Bush Negroes**, of Guiana G-183
- Bushnell, David** (1742-1824), inventor, born Saybrook, Conn.; built man-propelled submarine with which unsuccessful attempts were made to blow up British warships during American Revolution; called father of submarine: S-314
- Bushnell, Horace** (1802-76), American theologian, born Litchfield, Conn.; exerted wide influence through his writings and preachings ('Principles of National Greatness'; 'Christ and His Salvation'; 'The Vicarious Sacrifice').
- Bush-tit**, a small titmouse T-100
- Bushwhackers**, term for guerrilla fighters; much used during Civil War for Southern sympathizers along border states.
- Business**, *Outline* E-154. *See also in Index* Accounts; Advertising; Banks and banking; Commerce; Coöperative societies; Copyright; Corporations; Credit; Economics; Fairs; Finance; Industries; International trade; Manufactures; Market; Panics; Stocks; Tariff; Taxation; Trade-marks; Transportation; Trusts; and chief industries by name. For list of terms commonly used in business, *see in Index* Economics
age shift in population, effect P-304b
arbitration policy A-246
commercial revolution creates new methods C-322
consolidation of small units I-744
laissez-faire doctrine I-74b, g
Business conversation C-347d
Business letters L-98c-d
Business psychology P-361
Busiris (*bû-sî'ris*), legendary king of

Key—cápe, át, fâr, fást, whát, fáll; mē, yēt, fērn, thére; ice, bít; rōw, wón, fôr, nôt, dō; cûre, bût, rýde, fúll, búrn:

- ancient Egypt who, to save his country from famine, sacrificed each year a stranger to Zeus; attempted to sacrifice Hercules but was slain by him.
- Bus'kin**, Greek shoe T-76
- Bus'tard**, European and Asiatic bird B-125
- Butacite**, a synthetic plastic P-246
- Butadiene** (*bū-tā-dī'ēn*), in synthetic rubber R-169a, 170, diagram R-169b
- Butane**, hydrocarbon of paraffin series, found in petroleum. *See also in Index* Paraffin series
- synthetic rubber, diagram R-169b
- use in gas engine G-19
- Butcher**, Samuel Henry (1850-1910), British classical scholar; translated (with Andrew Lang) Homer's 'Odyssey' quoted G-172
- Butcher-bird**, popular name of shrikes S-135, picture B-123, color plate B-139
- Bute** (*būt*), John Stuart, 3d Earl of (1713-92), British statesman; supporter of royal autocracy; confident of and privy counselor to George III; prime minister 1762-63.
- Butco** (*bū'tē-ō*), a genus of hawks B-288, H-246
- Butler**, Andrew Pickens (1796-1857), American senator from South Carolina
- Sumner attacks S-326
- Butler**, Benjamin Franklin (1818-93), American lawyer, soldier, and politician, born Deerfield, N. H.; Civil War general; his military administration of New Orleans (1862) was bitterly resented by Confederates, Jefferson Davis proclaiming him a felon to be hanged if captured.
- Butler**, Ellis Parker (1869-1937), American writer of humorous stories and verse, born Muscatine, Ia. ('Pigs Is Pigs'; 'Philo Gubb').
- Butler**, John (died 1794), American loyalist; commanded guerrilla band, chiefly Indians, in Revolution; bitterly hated for part in Wyoming massacre.
- Butler**, Nicholas Murray (born 1862), American educator and publicist, born Elizabeth, N. J.; president of Columbia University after 1902; active in national and international affairs; president Carnegie Endowment for International Peace after 1925; shared Nobel Peace Prize (1931) with Jane Addams ('The Meaning of Education'; 'The Faith of a Liberal'; 'Across the Busy Years').
- Butler**, Pierce (1744-1822), American statesman, born County Carlow, Ireland; as representative in state legislature (1778-89), championed "back-country" though himself a rich planter; U. S. senator 1789-96, 1802-6; broke with Federalist party after 1792.
- Butler**, Samuel (1612-80), English satirist, author of 'Hudibras', a satiric poem against Puritanism.
- Butler**, Samuel (1835-1902), English satirical novelist and critic, compared, for biting irony, with Swift ('The Way of All Flesh'; 'Erewhon'; 'Notebooks').
- Butler**, Sir William Francis (1838-1910), British soldier and author, born Suirville, county Tipperary, Ireland; in Canada 1867-73 where he took part in Red River expedition, explored in Saskatchewan and the Rocky Mountains ('The Great Lone Land'; 'The Wild Northland').
- Butler**, William Orlando (1791-1880), American general, born Jessamine County, Ky.; served in War of 1812; member of Congress 1839-43; commanded army in Mexican War (1848).
- Butler**, Pa., city 30 mi. n. of Pittsburgh, in coal, limestone, natural gas, and oil region; pop. 24,477; glass, automobiles, iron and steel products, railroad cars, oil-well supplies, refined oil and by-products.
- Butler Art Institute**, Youngstown, Ohio Y-209
- Butler University**, at Indianapolis, Ind.; chartered 1850 by Disciples; colleges of liberal arts, religion, and education.
- Butte** (*būt*), Mont., 47 mi. s.w. of Helena; largest city in state; pop. 37,081; in rich copper mining region and site of famous Anaconda mine; zinc, manganese, gold, and silver also produced; state school of mines: M-243, 246, map M-243
- Butte**, a hill P-201
- Arizona, picture A-291
- North Dakota, picture N-165
- Butter** B-281-2
- churn D-4; colonial, picture A-169; electric, picture D-3; goat-skin, picture P-130
- content, picture B-282
- food value B-282, F-145; calories, table F-144b
- Jersey cow production D-2
- making D-4, picture D-3
- original uses B-282
- producing regions D-5
- Canada Q-4
- Denmark D-52
- Netherlands N-68, D-5
- United States D-5: Minnesota M-194; Wisconsin W-124
- substitutes O-221-3
- test for oleomargarine O-223
- yak's milk Y-203
- Butter-and-eggs**, an herb (*Linaria vulgaris*) of the figwort family, common in fields and waste places, having terminal clusters of pale yellow flowers tipped with orange, shaped like a snapdragon; also called toadflax and ramsted: N-39
- Butter cracker** B-232
- Buttercup**, a plant B-282
- marsh marigold M-71, picture M-64
- Buttercup**, Little, in Gilbert and Sullivan's opera 'Pinafore', bumboat woman and former baby farmer who interchanged the Captain and Ralph Rackstraw when they were babies.
- Butterfish**, large group of small fishes (*Stromateidae*) with short, compressed bodies and smooth, bright scales; excellent food fish, known in the Mediterranean as fiatola, in the Atlantic as dollar-fish, or harvest-fish, and in the Pacific as poppyfish or California pompano.
- Butterfly** B-282-6, color plates B-283a-b, I-87a-b, N-38a-b. *See also in Index* Moth
- antennae B-284, picture B-285
- books about H-313g
- caterpillars B-284, C-98-100, color plate B-283a-b
- chrysalis (pupa) stage B-284, P-368, picture B-286, color plate B-283a-b
- colors B-284, color plates B-283a-b, I-87a-b, N-38a-b: sex difference, color plate B-283a-b
- eggs, pictures B-285, E-193
- leaf, protective coloration P-354, pictures P-355, I-85
- life history B-284, C-98, color plate B-283a-b
- moth distinguished from B-284, color plate B-285a-b
- tropical B-284, color plate I-87a-b
- Butterfly-bush**. *See in Index* Buddleias
- Butterfly dog**, or papillon D-83
- Butterfly fish**, of family *Chaetodontidae* F-73, picture F-67, color plate O-200a-b
- Butterfly-flower**. *See in Index* Schizanthus
- Butterfly weed**, or pleurisy root, a perennial herb of the milkweed family M-174
- Butterine**, or oleomargarine O-221-3
- test for O-223
- Buttermilk** M-173
- Butternut**, or white walnut, a tree B-286
- nuts used as dye D-121
- Butterwort**, a genus (*Pinguicula*) of small perennials of the bladderwort family growing in damp places; has broad fleshy leaves greasy to the touch; flowers solitary, white to purple and yellow.
- Butterworth**, Hezekiah (1839-1905), American writer of children's stories and verses, born Warren, R. I. ('Zig-Zag Journeys').
- Button** B-286-8
- early uses B-286
- industry, U. S. B-287
- kind and sources C-275: metal, bone, glass B-288; pearl B-287, I-122; vegetable ivory B-287-8
- sewing, picture S-92
- Button-bush**, a shrub of the genus *Cephalanthus* of the madder family; has pointed oblong leaves, opposite or in whorls of 3; fragrant small white flowers in globular heads.
- Buttonholes**, how to make S-88-9
- Button lac** L-52
- Button snakeroot**. *See in Index* Liatris
- Buttonwood**, or sycamore S-360
- Buttress**, in architecture A-269
- flying buttress A-268, 269, pictures A-267, E-329
- Butvar**, a synthetic plastic P-246
- Bu'tyl**, combining radical (C₄H₉) of butane.
- Butyl acetate**, a solvent, formed of butyl and ethyl linked by CO₂
- lacquer L-52
- Butyl alcohol**, a compound (C₄H₉OH) of hydroxyl and butyl
- bacteria produce B-12
- solvent L-52, P-373
- Butylene**, hydrocarbon, diagram R-169b
- Butyl rubber** R-170, diagram R-169b
- Butyric** (*bū-tīr'ik*) acid, an organic compound (C₄H₇COOH) which gives odor to rancid butter: F-24
- Buxaceae** (*būks-ā'sē-ē*). *See in Index* Box family
- Buzfuz**, Sergeant, in Dickens' 'Pickwick Papers', lawyer in Bardell vs. Pickwick breach-of-promise case, picture D-67
- Buz'zard** B-288, color plate B-130
- Buzzard hawk** H-246
- Buzzards Bay**, Mass., an inlet of the Atlantic on the s. coast of Mass., map M-82
- Cape Cod Canal C-80, C-69
- Byblos** (*bīb'lōs*), ancient city on site of modern Jebel in Syria on Mediterranean coast about 25 mi. n.e. of Beirut; called Gebal in Bible; early center of Phoenician civilization; valuable remains of Egyptian occupation in 14th century B.C.; later chief fortress of Philistines until their defeat by Israelites.
- Bydgoszcz** (*bid'gōshitch*), or Bromberg, Poland, city on canal between Oder and Vistula rivers; formerly in province of Posen, Prussia; pop. 120,000; important trade center: map E-326d

ü=French u, German ü; gem, go; thin, then; ù=French nasal (Jean); zh=French j (z in azure); k=German guttural ch

BYZANTINE RULERS

Under Diocletian (A.D. 284), the Roman Empire was divided into the Eastern Empire and the Western Empire, but it was not until the death of Theodosius (A.D. 395) that the two were finally separated. The name "Byzantine" applies to the Eastern Empire from that time on. For Eastern rulers preceding Arcadius, see in *Index* Rome, Emperors of, *table*. In this table overlapping dates indicate co-rulers, except in the case of the Latin Emperors who, during the Crusades, were set up as rivals to the Nicæan Emperors.

| | | | |
|----------------------|----------------------------------|-----------|------------------------------|
| 395-408 ^a | Arcadius | 1028-50 | Zoë |
| 408-450 | Theodosius II | 1028-34 | Romanus III, Argyropoulos |
| 450-457 | Marcianus | 1034-41 | Michael IV, the Paphlagonian |
| 457-474 | Leo I | 1041-42 | Michael V, Kalaphates |
| 474 | Leo II | 1042-54 | Constantine IX, Monomachus |
| 474-491 | Zeno | 1054-56 | Theodora |
| 491-518 | Anastasius I | 1056-57 | Michael VI, Stratioticus |
| 518-527 | Justinus I | 1057-59 | Isaac I, Comnenus |
| 527-565 | Justinian I | 1059-67 | Constantine X, Dukas |
| 565-578 | Justinus II | 1067 | Andronicus |
| 578-582 | Tiberius, Constantinus | 1067 | Constantine XI |
| 582-602 | Mauritius | 1067-71 | Romanus IV, Diogenes |
| 602-610 | Phocas I | 1071-78 | Michael VII, Parapinakes |
| 610-641 | Heracleus I | 1078-81 | Nicephorus III, Botaniates |
| 641 | Constantine III | 1081-1118 | Alexius I, Comnenus |
| 641 | Heracleon | 1118-43 | John IV, Calus |
| 641-668 | Constans II | 1143-80 | Manuel I |
| 668-685 | Constantine IV | 1180-83 | Alexius II |
| 685-695 | Justinian II | 1182-85 | Andronicus I |
| 695-698 | Leontius II | 1185-95 | Isaac II, Angelus-Comnenus |
| 698-705 | Tiberius III, Apsimar | 1195-1203 | Alexius III, Angelus |
| 705-711 | Justinian II (restored) | 1203-04 | Alexius IV |
| 711-713 | Philippicus | 1204 | Alexius V, Dukas |
| 713-715 | Anastasius II | | <i>Latin Emperors</i> |
| 715-717 | Theodosius III | 1204-05 | Baldwin I |
| 717-741 | Leo III, the Isaurian | 1205-16 | Henry VI |
| 741-775 | Constantine V, Kopronymus | 1216-17 | Peter de Courtenay |
| 775-780 | Leo IV | 1218-28 | Robert de Courtenay |
| 780-797 | Constantine VI | 1228-61 | Baldwin II |
| 797-802 | Irene | | <i>Nicæan Emperors</i> |
| 802-811 | Nicephorus I | 1206-22 | Theodore I, Lascaris |
| 811 | Stauracius | 1222-54 | John Dukas Vatatzes |
| 811-813 | Michael I, Rhangabé | 1254-59 | Theodore II, Lascaris |
| 813-820 | Leo V, the Armenian | 1258-61 | John IV, Lascaris |
| 820-829 | Michael II | | <i>The Paleologi</i> |
| 829-842 | Theophilus I | 1261-82 | Michael VIII |
| 842-867 | Michael III | 1282-1328 | Andronicus II |
| 842-866 | Bardas | 1295-1320 | Michael IX |
| 867 | Theophilus II | 1328-41 | Andronicus III |
| 867-886 | Basil I, the Macedonian | 1341-47 | John V |
| 886-912 | Leo VI, the Wise | 1347-54 | John VI, Cantacuzène |
| 912-913 | Alexander III | 1355-76 | John V (restored) |
| 913-959 | Constantine VII, Porphyrogenitus | 1376-79 | Andronicus IV |
| 919-944 | Romanus I, Lecapenus | 1379-91 | John V (restored) |
| 959-963 | Romanus II | 1390 | John VII |
| 963-1025 | Basil II, Bulgaroctonus | 1391-1425 | Manuel II |
| 963-969 | Nicephorus II, Phocas | 1425-48 | John VIII |
| 969-976 | John I, Tzimiscus | 1448-53 | Constantine XII or XIII |
| 1025-28 | Constantine VIII | | |

Byedny (*bēd'ne*), or Biedny, Demyan (born 1883), pen name of Yefim Alexeyevich Pridvorov, Russian journalist-poet and propagandist ('The Workmen's Hymn')

place in Russian literature R-197

Byolinsky (*bēl-in'skē*), or Belinsky, Visarion Grigorevich (1810-1848), Russian critic and philosopher.

Byelorussian (White Russian) Soviet Socialist Republic, a constituent republic of Soviet Union; situated in w. Russia; 49,035 sq. mi.; pop. 5,570,000; cap. Minsk. An area of about 41,500 sq. mi., with a population of 4,500,000, was added to this by annexations from Poland in 1939.

Byelukha (*bēl-g'kū*) ("White" Mountain), Siberia, highest mountain in Altai range; 14,800 ft.

Byely (*bā'lē*), or Bely, Andrey (1880-1934), pen name of Boris Nikolaevich Bugaief, Russian mystic poet and novelist ('Petersburg'; 'The Urn'): R-197

By-law, a rule or regulation made by a society or organization (incorporated or unincorporated) for its government: P-79

Byng (*bīng*), Julian Hedworth George, first Viscount of Vimy (1862-1935), British general and statesman; served in Boer War and

World War of 1914-18; commanded Canadian Corps at Vimy Ridge; governor general of Canada 1921-26; Chief Commissioner London police 1928-31.

Byn'ner, Witter (born 1881), American poet, born Brooklyn, N. Y.; later lived in Santa Fe, N. M.; verse facile and varied; in 'Indian Earth' interpreted Indian life in the Southwest; translated and compiled 'The Jade Mountain', Chinese anthology (with Kiang Kang-Hu).

By-pass condensers, in radio R-23, *diagram* R-19

By-product, a secondary product, especially, a product obtained as part of the manufacture of another product
agricultural P-245c, C-343; corn C-368, *chart* C-366b; potash from sugar beets N-58. See also in *Index* Farm products

alum A-137
ammonium sulphate F-27
coal-tar C-288-9, C-298, C-81
conservation aided by C-342-3
cotton C-376, *pictures* C-381
dyes D-122
fish F-82
glycerin G-108
hair H-196
iodine I-118
leather L-85
Leblanc soda process S-190

lignin P-61
lumber P-245c, C-342
meat-packing M-97, G-107-8: hog H-315

of charcoal C-144

petroleum P-151

selenium S-76

silver S-152

soy bean M-51

whale fishing W-80

Byrd, Richard Evelyn (born 1888), American aviator and explorer B-289, *picture* A-73

Antarctic exploration B-289, P-286, A-214, *map* A-215, *pictures* P-285, R-17

North Pole flight B-289, *map* A-277
transatlantic flight B-289

Byrd, or Birde, William (1542?-1623), English composer; organist at Lincoln Cathedral and at Chapel Royal; one of greatest of English composers.

Byrd, William (1674-1744), American lawyer, born Westover, Va.; founder of Richmond and Petersburg: R-107

Byrne, Donn (Brian Oswald Donn-Byrne) (1889-1928), Irish-American novelist and short-story writer, born New York City of Irish parents; spent childhood and youth in Ireland; story-telling power, romantic atmosphere, and undercurrent of humor ('Messer Marco Polo'; 'The Wind Bloweth'; 'Blind Raftery'; 'Hangman's House').

Byrnes, James Francis (born 1879), lawyer and public official, born Charleston, S.C.; U. S. representative 1911-25; U. S. senator 1931-41; associate justice U. S. Supreme Court 1941-42; director Office of Economic Stabilization 1942-43; made director of war mobilization May 1943: N-13

Byron, George Gordon, Lord (1788-1824), English poet B-289, E-286, *picture* E-287

'Bride of Abydos', quoted H-287
quoted P-270

Byssus (*bis'ūs*), in mussels C-259

Bytown, Canada, early name of Ottawa O-255

Byzantine architecture A-262-3, B-290, *pictures* A-261, 262

development of dome, A-262, *picture* A-261; mosques in Constantinople, *pictures* A-262, M-214

influence in Russia, *picture* R-186

Mosque of Achmet, *picture* A-262

St. Mark's Cathedral V-277, *picture* E-327

Santa Sophia A-262, B-290, *picture* A-261

Byzantine art P-14, B-290

crowns G-25, *picture* G-27

jewelry G-25

mosaic, *pictures* P-15, A-265

reliquary, *picture* G-26

textile design T-63

Byzantine Empire, also called Eastern Empire or Greek Empire B-289-90. For list of Byzantine rulers see *table* on preceding page

barbarian invasions G-123-4

Constantine founds Constantinople C-346, I-152

Crusaders take (1204) B-290, V-279

Eastern Orthodox church C-232,

G-164, R-72, B-290

exarchate of Ravenna R-53

Justinian, J-231-2, B-290: conquest

of Vandals by Belisarius V-272

Turks take Constantinople (1453)

B-290, T-162

Byzantium (*bī-zān'shī-ūm*), ancient Greek city on site of Constantinople (Istanbul) C-344, I-152